THE MEASUREMENT OF EFFORTS TO ENHANCE THE EFFECTIVENESS OF NAVFAC RDT&E INVESTMENTS

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THESIS

THE MEASUREMENT OF EFFORTS TO ENHANCE THE EFFECTIVENESS OF NAVFAC RDT&E INVESTMENTS

by

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June 1977

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The concept of using subjective evaluations to measure effectiveness in a more timely manner was also introduced and demonstrated to be a useful approach to estimate ROI with reasonable accuracy.

An automated information system using the Statistical Package for the Social Sciences was also expanded in an operational environment to accommodate the data processing requirements of an effectiveness measuring system for the Facilities Engineering Support Office, a service organization of the Navy's Civil Engineering Laboratory.

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by

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ABSTRACT

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Previous efforts by students at the Naval Postgraduate School, to measure the effectiveness of the Assistance Program and to develop an automated information system to satisfy the data processing requirements of the Facilities Engineering Support Office of the Navy's Civil Engineering Laboratory, laid a foundation which was invaluable in the preparation of this thesis. Many were involved in those efforts. In particular, the contributions of Lieutenant Commanders Jack E. Hendrickson and William G. Fisher and Messrs Kenneth M. Suess and James F. Thaler are hereby gratefully acknowledged.

I. INTRODUCTION

A. PERFORMANCE MEASURES

The need to measure the performance of programmed efforts has always been of concern to the manager, whether he is located at the operational or headquarters level. In these days of limited resources, the need has become more critical. Two common measures of performance are efficiency and effectiveness. Drucker [Ref. 1]. in his discussion of the difference between efficiency and effectiveness, stated:

> "Effectiveness is the function of success--efficiency is a minimum condition for survival after success has been achieved. Efficiency is concerned with doing things right. Effectiveness is doing the right things.
>
> Efficiency concerns itself with the input of effort into all areas of activity. Effectiveness, however, starts out with the realization that in business, as in any other social organism, 10 or 15 percent of the phenomena--such as products, orders, customers, markets, or people--produce 80 to 90 percent of the results. The other 85 to 90 percent of the phenomena, no matter how efficiently taken care of, produce nothing but costs (which are always proportionate to transactions, that is busy-ness)."

This study concentrates on efforts to measure effectiveness. However, the effectiveness of performance in certain areas of operations has essentially eluded evaluation efforts. This is generally true in the area of research and development [Ref. 2].

B. MEASURING EFFECTIVENESS

In order to evaluate the effectiveness of research efforts, the manager must first decide what is going to be evaluated. In the case of a particular program, the purpose of that

program must be clearly stated to allow a definition of what is valuable. The manager must then either estimate the potential value or benefit of future events, assuming that those events will in fact take place, or wait until the results of the research are known. At some later date, if the results are committed to practice, he will assess the benefit that has been realized. The former approach is frought with subjectivity. The later approach entails an unacceptable waiting period, as well as a significant degree of subjectivity. Neither approach is desirable.

Coupled with the inherent problems of subjectivity and timeliness, is the question of which evaluation techniques to use to measure effectiveness. In the area of research and development, they do not exist, for the most part, although progress has been made in certain limited areas. Finally, the measuring system must not require an inordinately large level of effort compared to the effort being evaluated. A small organization or a small program should, therefore, only allocate a limited amount of resources to measuring effectiveness. Managers faced with these obstacles and constraints are often inclined to abandon hope of quantitatively measuring program effectiveness.

An alternative to abandoning hope, is to consider adapting those techniques for evaluating benefit which are workable, and through the use of a sampling approach, obtain sufficient data to estimate total benefit at a level of accuracy commensurate with the resources available for

measuring effectiveness. The success of such an effort offers the manager a capability that does not currently exist, at an affordable price.

C. PURPOSE OF THE STUDY

The objective of this study is to develop an effectiveness measuring system based on sampling procedures and to demonstrate that it is a feasible approach to meeting management requirements for information on the effectiveness of a small service program. Such a system will provide a viable alternative in those situations where the lack of sufficient resources, or the relative magnitude of the program effort, precludes the accomplishment of full-scale evaluation efforts. Specifically, a previously developed evaluation technique will be optimized and applied to a selected number of individual service requests to provide the basis for estimating the annual return on investment (ROI) for the whole service program. It will be demonstrated that the data resulting from the evaluation of selected individual asssistance requests, when processed by a computer-aided management information system, provides a reasonably accurate and economically affordable basis for estimating the annual ROI of resources expended by the Navy's Civil Engineering Laboratory in executing the Naval Facilities Engineering Command's Assistance Program.

II. BACKGROUND

A. NAVAL FACILITIES ENGINEERING COMMAND

The Naval Facilities Engineering Command (NAVFAC) provides engineering, material and equipment support to the Chief of Naval Operations, the Operating Forces of the Navy, the Marine Corps, components of the Naval Material Command, and other offices [Ref. 3]. NAVFAC's Research Program is directed primarily towards items of new or improved materials, equipment or engineering techniques which will significantly improve solutions to specific engineering problems pertaining to the technical planning, design, construction, operation and maintenance of the shore activities and fixed surface and subsurface structures of the Navy [Ref. 3].

NAVFAC's Research Program is specifically administered by the Assistant Commander for Research and Development (Code 03). NAVFAC Code 03 therefore has the responsibility to ensure that the output of Research and Development (R&D) is transferred to shore activities of the Navy and to ensure that maximum effectiveness is achieved from R&D investments.

NAVFAC's link to the shore activities is primarily through its Engineering Field Divisions (EFDs), its Public Works Centers (PWCs), its construction program administered by Officers in Charge of Construction (OICCs) and Resident Officers in Charge of Construction (ROICCs), and Public Works Departments of individual shore activities. Figure 1 shows these organizational and technical relationships.

NAVAL FACILITIES ENGINEERING COMMAND

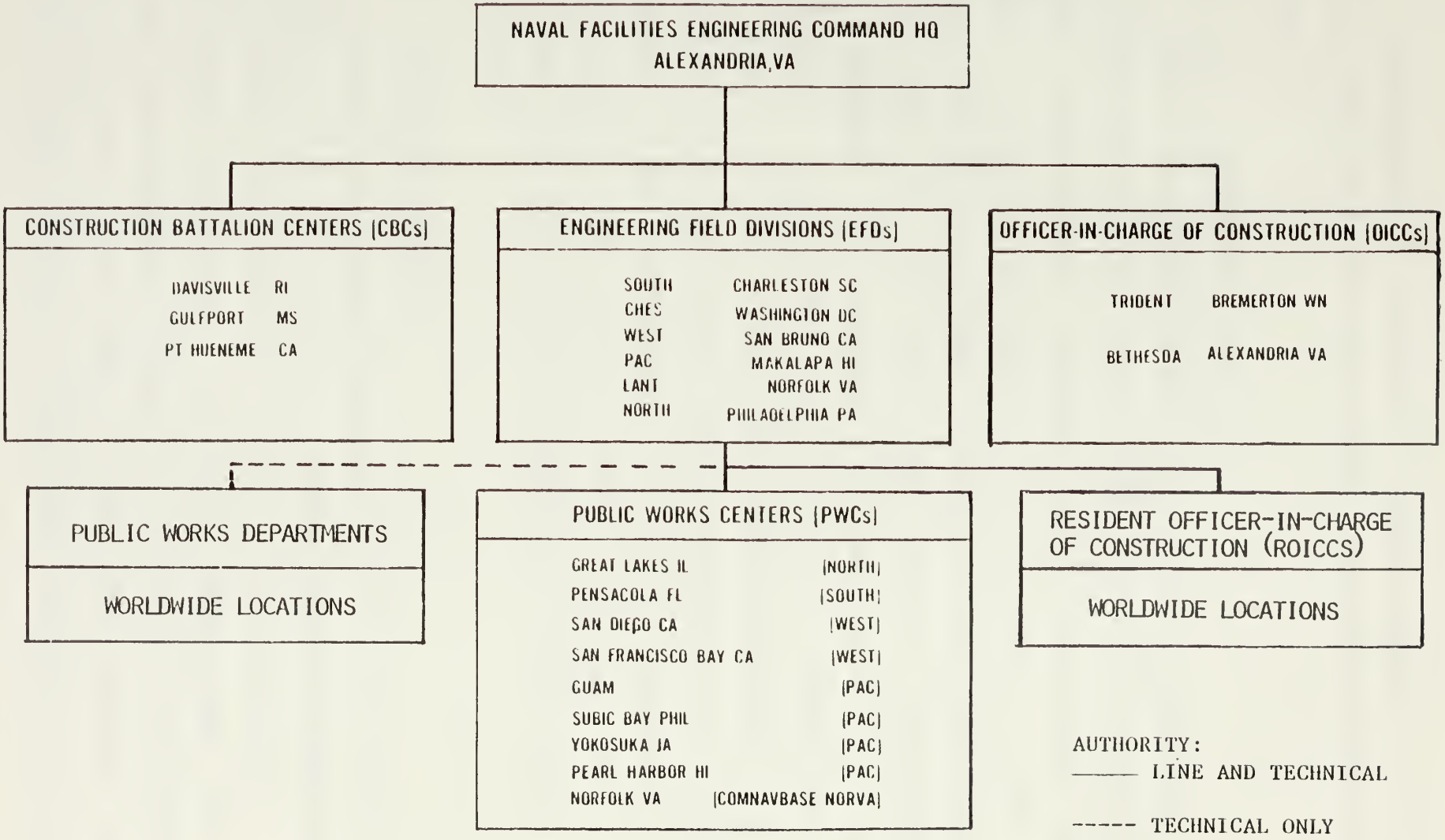

Figure 1 NAVFAC Organizational and Technical Relationships

A major portion of NAVFAC's research program is assigned to and executed by the Navy's Civil Engineering Laboratory (CEL).

B. CIVIL ENGINEERING LABORATORY

The Civil Engineering Laboratory (CEL) is under the administrative control of the Naval Construction Battalion Center, Port Hueneme, California, and is the principal RDT&E Center for shore and fixed surface and subsurface ocean facilities and for the Navy and Marine Corps Construction Forces [Ref. 4]. The staff of CEL consists of approximately 300 personnel, 175 of which are professional engineers and scientists, representing a large variety of disciplines.

Funding for CEL's FY-76 RDT&E program amounted to 13 million dollars with approximately 70 percent of the program supported by Navy RDT&E funds. The program represented approximately 250 individual efforts, called work units. One of these work units was RDT&E Assistance to Naval Shore Activities.

C. ASSISTANCE PROGRAM

The work unit RDT&E Assistance to Naval Shore Activities, referred to as the Assistance Program in the remainder of this report, was initiated at CEL in 1963 using NAVFAC Exploratory Development (6.2 category RDT&E) funds. The purpose of the Assistance Program is to provide quick-response service, upon request and at no cost to the requestor, directly to users located at NAVFAC field activities and Public

Works Departments of shore activities throughout the Naval Shore Establishment. These efforts normally take the form of short-term investigations, analyses and tests to determine the relative value and suitability of new materials, equipment, processes, and construction and maintenance procedures [Ref. 5]. The key words in this statement are "to provide services upon request." Thus the Assistance Program is driven by the expressed needs of its users.

In the process of assisting shore activities, CEL researchers provide field personnel with an early awareness of current R&D efforts and preliminary and final results that relate to their areas of expressed interest. This results in narrowing the gap between research and use by putting the results of research to work at the earliest practicable time to solve current problems being experienced by field personnel involved in facilities engineering matters.

During FY-76, a review of Navy RDT&E programs led to a decision by the Director of Defense Research and Engineering that the use of Navy Exploratory Development funds was not appropriate for the provision of assistance to Naval shore activities. Accordingly, an alternative funding source had to be developed if the Assistance Program was to be continued after FY-76.

After reviewing the situation, NAVFAC management decided that there was sufficient benefit in providing assistance to Naval shore activities and that these efforts should be continued using mission management funds. Although performance

measures applied to CEL assistance efforts related to activity and growth in usage, rather than effectiveness, this information was used as input to this NAVFAC decision. These performance measures are discussed in some detail in Appendix A.

D. FACILITIES ENGINEERING SUPPORT OFFICE

The Facilities Engineering Support Office (FESO) was established by CEL and funded by NAVFAC to perform the function of coordinating services and communications related to providing assistance to shore activities. This was a realization of management desire to focus attention on this aspect of CEL's efforts and to ensure that timely and effective laboratory support was provided in response to field needs. The function was placed in CEL's organization as a staff component of the Technical Director. This location reflects management interest and dedication to this service and allows for easy and direct access to CEL's primary resource--its people. The basic organization of CEL is shown in Figure 2. The primary FESO functions related to the Assistance Program are outlined in Figure 3.

NAVFAC's decision to continue the Assistance Program utilizing mission management funds was based on performance measures of program activity mentioned earlier and other subjective judgements of the value of the program. Accordingly, the need to quantify the effectiveness of the Assistance Program became a matter of increased management interest and importance. Developing a system to measure the effectiveness

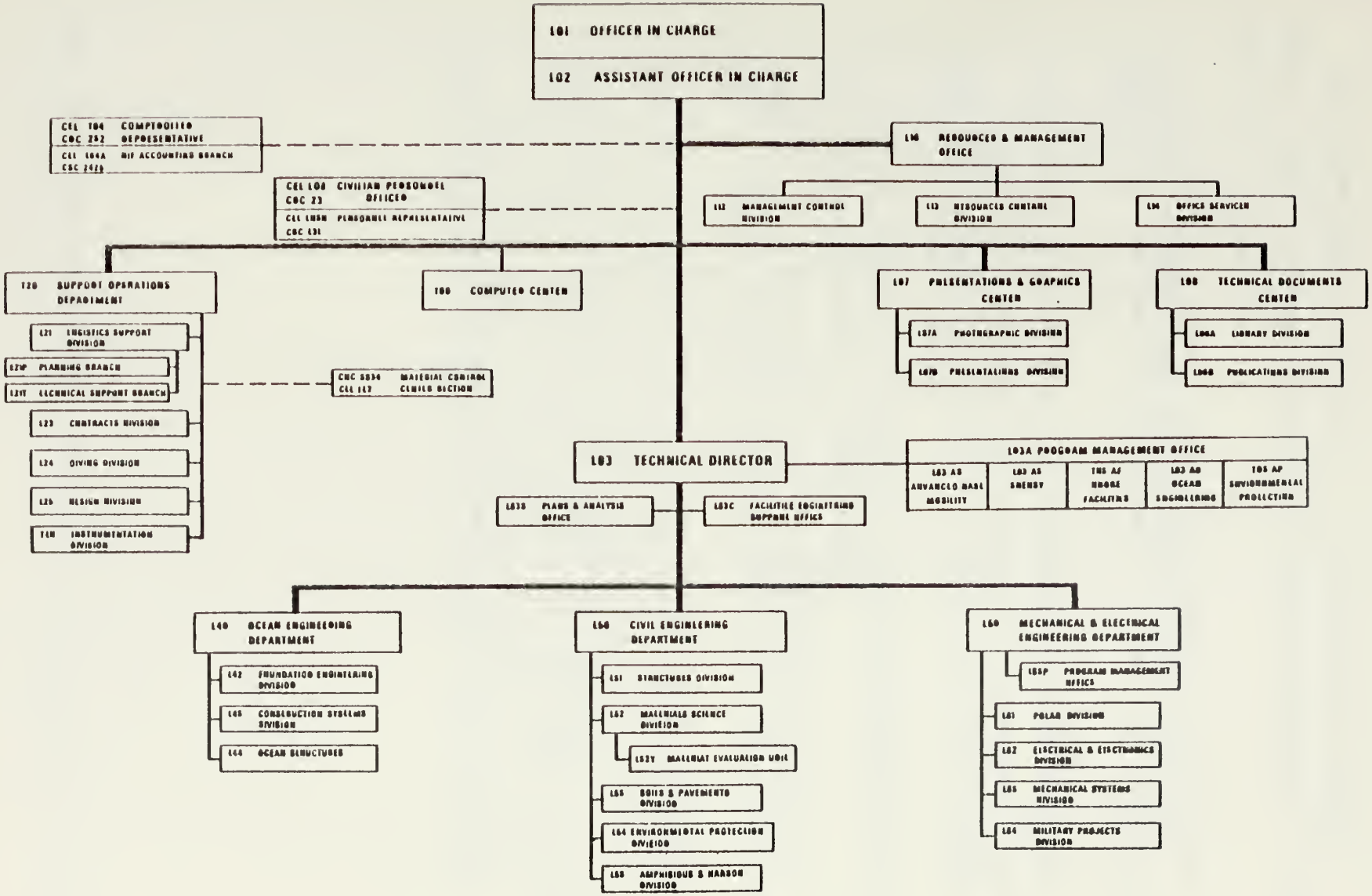

Figure 2 Organization of the Civil Engineering Laboratory

The functions of the Facilities Engineering Support Office (FESO) related to providing RDT&E Assistance to Naval Shore Activities are:

1. Ensure that timely engineering support services are provided to NAVFAC and Public Works field activities throughout the Shore Establishment on facility engineering matters.

2. Serve as a point of contact at CEL for liaison with field activities on facility engineering RDT&E matters.

3. Search out, develop, and maintain a knowledge of the assistance needs of these field activities and provide them with a knowledge of CEL's capabilities and interest in meeting their needs.

4. Act as a project coordinator on assistance projects for field activities to ensure timely and effective laboratory responsiveness to these needs.

5. Act as a focal point for correspondence relating to assistance to field activities, including promotion of direct contact between field personnel and individual members of CEL's technical staff.

6. Effect utilization of currently available research results as a means of meeting the needs of field activities.

7. Formulate plans for RDT&E support of field units by CEL where a solution is not currently available, including fostering the initiating of RDT&E task proposals and obtaining field activity sponsorship of such RDT&E proposals.

8. Study the spectra of assistance needs of the field activities, synthesize these needs and their solutions, and disseminate findings to these field activities [Ref. 4].

Figure 3. FESO Functions Related to The Assistance Program

of assistance efforts in terms of benefits to users would satisfy management requirements, and also provide valuable feedback information to guide overall FESO efforts.

III. SCOPE OF THE WORK

A. ASSUMPTIONS

The basic assumption of this study is that a pressing need exists to obtain quantified information on the effectiveness of the Assistance Program on an on-going basis.

A parallel assumption is that the expense of evaluating all assistance requests, on an on-going basis, is not warranted by the level of effort expended in providing assistance services. Even if it were justified, the effort required for such an evaluation would exceed the resources available to the FESO.

The prevailing rationale is that the primary purpose of the Assistance Program is to provide service to field users. Secondarily, the Assistance Program should be capable of producing an acceptable level of benefit for those users, which at a minimum would require that it pay for itself, or be self-supporting. Of course, this must be taken figuratively, since there is no exchange of funds between shore activities and CEL with regard to the Assistance Program. In the case of commercial businesses, the final criteria for benefit, stated in terms of profit and loss, is return on investment. This criteria could be approximated for the Assistance Program by a measure of discounted present value of estimates of benefit provided by the users of the service. Accordingly, the Assistance Program should produce a minimum ROI of 1.0.

The need to generate and process evaluation data with a relatively modest effort requires adoption of a computer-based effectiveness measuring system. However, the system must be operable with the data processing capability that is currently available to CEL. The system should be based on evaluating samples of the total requests received. The system should be flexible to allow evaluation of a variable number of assistance requests, or all requests for that matter.

There are certain risks associated with the gathering of information related to the value of a particular effort. In the case of the Assistance Program these risks could materialize in the form of negative attitudes toward CEL, toward the Assistance Program, or toward participating individuals. The creation of such negative attitudes would have a debilitating effect on the Assistance Program resulting in the decreased use of CEL as a resource by potential users, and decreased interest in participating, or in recording participation, by CEL personnel. Therefore, only those assistance efforts which are judged to provide measurable benefit should be included in field evaluations of benefit.

B. LIMITATIONS

The measuring system estimates the effectiveness of the Assistance Program during a particular period of time. It does not measure actual benefit. This would require considerable effort over extended periods of time. It does measure a collective expression of perceived benefit that users are

willing to make, stated in terms of estimated return on investment.

Evaluating the benefits of a sample of the total requests received during a given period of time will not provide the basis for an exact value for the estimated total benefit during that period. The benefits of the individual assistance requests are normally distributed continuous variables. At best, these benefit values can be used to develop a reliable estimator of the estimated total benefits that would accumulate during that period, with a known level of accuracy. For example, a significantly large benefit, compared to other benefits, might not be included in the sample and, therefore, would not influence the calculation of ROI. This would result in understating the range of estimated ROI.

There is a risk in connection with the possible misuse of ROI data. It should be clearly understood that the estimated ROI for one period of time cannot be used to answer questions about the level of benefit achieved by the Assistance Program during other periods of time.

There is a greater risk that ROI information developed to measure the effectiveness of the Assistance Program during various periods of time might be used in such a way as to be inconsistent with the basic purpose of the program. Requests are received in random fashion, at the discretion of requesting personnel at shore activities. Therefore, there is no logical basis for assuming that there should be a significant correlation between ROI estimated for different periods of

time, or more importantly, that the ROI should continue to increase from year to year. The later assumption amounts to establishing a goal "to make an increasing larger profit, while providing a free service." If the primary purpose of the Assistance Program is to provide a service, at no cost to the user, serious consideration should be given to being content to see the value of ROI remain above 1.0, at which point the cost of providing the service is offset by benefits to its users.

The benefits of the Assistance Program are many and varied. People in the field, at shore activities around the world receive the primary benefits. However, engineers and scientists at CEL share in the benefits of the Assistance Program too.

Although the effectiveness of the program will be stated in terms of estimated ROI, it should be noted that these data are based only on that part of the total benefit that can be quantified with reasonable accuracy and credibility. Since a variety of additional benefits result from assistance efforts, it is worthwhile to list some of them, so they will not be overlooked until such time that techniques become available to quantify them. Some of these "additional benefits" are listed in Appendix B.

IV. METHODOLOGY

A. SELECTION OF AN OPERATIONAL SYSTEM TO MEASURE EFFECTIVENESS

Since its inception, the FESO has been interested in the evaluation of benefits as a measure of effectiveness, for use by CEL and NAVFAC. Efforts were undertaken at the Naval Postgraduate School to measure the effectiveness of the FY-72 and FY-73 assistance efforts [Refs. 6 and 7]. These efforts produced a basic foundation for later efforts, although the results were not definitive in that they were based on less than adequate data gathering instruments, or questionnaires for gathering evaluation data, and insufficient coverage of the shore activities served. Later efforts by Hendrickson and Fisher [Ref. 8], to measure the effectiveness of the FY-74 Assistance Program, produced a more comprehensive questionnaire and increased the evaluation efforts to include a larger postion of the activities served. A breakthrough also resulted in that the techniques for evaluating the worth of tangible and intangible benefits were advanced considerably. Although the study produced a workable system, the cost to measure program effectiveness on an on-going basis, using those techniques to evaluate each assistance request received by CEL, was considered prohibitively expensive in terms of available resources and in relation to the total cost of providing assistance. Study results, which indicated a mean benefit of $2.72 for each dollar expended to provide assistance during FY-74, coupled with the potential cost of similar

measurement efforts, did relieve the immediate pressure for continuing efforts to measure return on investment for the program. This led to a decision in FY-75 to defer further effectiveness measuring for several years. The shift in funding source to NAVFAC mission management funds created need for an operable system. It was believed that an operational system incorporating those techniques could be developed based on a modification of the Hendrickson and Fisher model. The cost barrier associated with evaluating all assistance requests received during a given period could be overcome by evaluating the benefit of a selected number of the requests and using these data as a basis for estimating the total benefit of all requests.

B. SELECTION OF A PERIOD TO STUDY

During FY-76, CEL responded to 612 individual assistance requests from Naval shore activities. Although some thought was originally given to including all those requests in the study, a review of the assistance activity during that year revealed several reasons why the study should focus on the last quarter of FY-76. The main reasons for selecting that period for study purposes were:

1. The total of 145 assistance requests during the fourth-quarter was approximately one-fourth of the total number of requests received during the entire year.
2. The total of 145 requests was approximately one-half of the number of requests treated in the Hendrickson and Fisher study of FY-74 assistance efforts.
3. The 145 requests should represent a large enough sampling population for study purposes.

C. SYSTEM MODEL

The system model is based on the evaluation of individual benefits to users. Although benefit is considered on a request-by-request basis, in the final analysis the model treats the entire Assistance Program as if it were a single CEL product resulting from a single investment, rather than a number of individual requests for assistance with their attendant costs and benefits. This follows the character of the R&D process, in that successes should make up for failures. Without failures progress will generally be slow because the approach will have been too conservative.

The model provides for input from the providers and users of assistance services and for administration and coordination by the FESO. The reasoning behind these features is discussed in Appendix C.

Specifically, the model recognizes that the investment required to respond to some assistance requests will not provide a measurable, commensurate return. This is not say that satisfying a particular request does not provide benefit, for satisfaction itself is a form of benefit. However, it is convenient from an operational viewpoint, and less disconcerting to all concerned, to classify those requests having marginal or intangible benefit as providing immeasurable or "zero" benefit, when measuring effectiveness.

No attempt is made to apportion credit to individual requests, or among the various requesting and responding groups. In this way, the overall rewards for participation

in the program are retained without the introduction of risk which would attend being involved in a request which was later shown to be of marginal value. In short, there was a conscious effort to avoid any appearance of penalizing the participants, whether they are located at CEL or at shore activities.

It is believed that this system will provide information NAVFAC Code 03 needs, to know whether it is doing the right thing in funding the Assistance Program with mission management funds.

Two questions can be asked in relation to justifying the investment of funds in the Assistance Program. These questions are:

1. Did the Assistance Program produce an acceptable level of benefit?

2. What level of benefit was achieved by the Assistance Program?

The answers to both of these questions are valuable, but each carries a different cost in terms of effort and timeliness of availability. Efforts to determine whether the Assistance Program produced an acceptable level of benefit during a given fiscal year could be carried out and completed during that fiscal year. Results would be available to management in time to influence decisions concerning program efforts in the following fiscal years. By contrast, evaluation efforts to determine the overall level of benefit for a given fiscal year would require more effort and could not be completed until after the end of that fiscal year. Thus valuable management information would not be available until after final

decisions had been made on funding of the next fiscal year's efforts. Also management pressure for this information could be expected to result in a period of concentrated evaluation effort shortly after the end of the fiscal year.

From an operational viewpoint, there was strong intuitive appeal for answering the first question. Yet, it is believed that effectiveness information on the overall level of benefit would be more useful, and therefore of more interest to management. In view of the importance of these two divergent views, an attempt was made to satisfy both of them.

D. EXPANDING THE FESO AUTOMATED INFORMATION SYSTEM

The feasibility of adapting a computer software package for a small service organization had already been demonstrated by Suess and Thaler [Ref. 9]. A computerized information system had been developed and demonstrated for the FESO using the Statistical Package for Social Sciences (SPSS). This system is currently being used by the FESO, a testimonial to the value of that effort.

Suess and Thaler stressed the importance of adequate supporting documentation in developing the information system. It was considered no less important when modifying the existing system, in that it would enable the FESO to understand and effectively maintain the automated information system using the SPSS. Accordingly, detailed documentation of the processing logic and operating procedures for expanding the FESO Automated Information System to process information on benefit was included as part of this study. The expansion of this system is discussed in Section VI.

V. FEASIBILITY OF MEASURING EFFECTIVENESS BY SAMPLING

A. OVERVIEW

The answer to the question of whether the Assistance Program produced an acceptable level of benefit during the fourth quarter of FY-76, when 145 requests were received, could be obtained by a somewhat simplistic sampling procedure which had considerable operation appeal. By contrast, the answer to the question of what level of benefit was achieved during that period would require application of a more rigorous procedure. Both procedures were pursued. Either of them, if shown to produce reasonably accurate estimates of benefit, would provide NAVFAC Code 03 with on-going information on program effectiveness within available CEL resources.

This section describes the efforts to develop and demonstrate an operational system to obtain adequate information on effectiveness measures with an affordable level of effort. Because of its detailed nature, the results obtained from the various approaches are previewed in this subsection, with the details included in subsections to follow.

The original approach was limited to determining whether the Assistance Program had produced an acceptable level of benefit. The initial procedure was to subjectively rank each request in terms of ranges of estimated potential benefit. Then the evaluation of individual requests with potentially large benefits would proceed and continue until the aggregated benefit exceeded the total cost of providing assistance. At

that point evaluation efforts would stop. Although these procedures were not followed exactly, in that efforts were not concentrated on evaluating potentially large benefits, it was shown that the benefits of ten evaluated requests, or approximately seven percent of the total of 145 requests, exceed the $53,766 cost of the program.

The direction of the study was then changed to an approach which measured effectiveness in terms of ROI, based on the evaluation of requests in randomly sampled groups of requests. The sampling population was reduced to 115 requests by eliminating 25 requests subjectively ranked as producing "zero" benefit and five duplicate requests. Three trials were made using a multiple group sampling procedure with three, four, and then five groups of four requests each. Ranges of total estimated benefit were then calculated assuming a 95% confidence interval. They were too wide. In addition, the lower limit was negative and therefore unacceptable. The range narrowed and converged toward acceptable limits with each succeeding trial. This was caused by the small number of sample groups and the wide range of individual benefits. This sampling procedure was abandoned before the lower limit of the range of estimated total benefit assumed a positive value, although the benefits of 20 requests, or 17 percent of the total requests, had been included in the calculations.

The random sampling approach was then changed to include a procedure that parallels attribute inspection in the manufacturing industry. Six additional trials were made using a

grouped sequential sampling procedure. The group size was progressively increased to include 4, 8, 12, 15, 18, and then 45 requests. Ranges of estimated total benefit were again produced, which were consistently narrower than those produced by multiple group sampling. An acceptable range was achieved with the second additional trial (No. 5) which included eight requests, or seven percent of the total. The range was still quite wide, but narrowed with each succeeding trial. Results based on the benefits of 45 evaluated requests indicated that the minimum acceptable estimated ROI for the Assistance Program during the fourth quarter of FY-76 would be realized within a range between seven and 24, with a confidence of 95 percent.

In view of the concern for operational simplicity, the potential for expanding the original subjective ranking approach to produce estimates of total benefit was then explored. Using this approach, the total benefit was estimated to be $707,017, which corresponded to a return on investment of 13.

It was also shown that the Assistance Program had produced an acceptable level of benefit. Identified benefits of the 45 evaluated requests totaled $324,017, or a return on investment of six.

B. SELECTION OF EVALUATION TECHNIQUES

Before the study had progressed vary far, the decision was made to have the EFD RDT&E liaison engineers evaluate the requests from their organizations as had been done in the FY-72, FY-73, and FY-74 surveys. They were requested to

coordinate the evaluation of those requests with the author administering the evaluation of requests from other organizations. A modified questionnaire was developed and used to obtain evaluation data from field users. The development of this questionnaire is discussed in Appendix D.

C. SUBJECTIVE RANKING

A review of the data from the three previous surveys revealed a wide range of individual benefit values with a small number, about five percent, of relatively large benefit values included among them. This review provided the basis for the original approach, which was to determine only if the Assistance Program had produced an acceptable level of benefit, i.e., a return on investment of 1.0. Some other minimum value of ROI could be selected, for this value defines what is considered an acceptable level of benefit, but recovery of cost was considered to be a minimum requirement.

Each of the 145 requests were subjectively ranked in terms of their estimated potential benefit using the same benefit value ranges included in the revised form for recording verbal requests for assistance. (Appendix E.) The results of this ranking effort, to subjectively identify the "larger" benefits, indicated that a total of five requests were each estimated to provide potential benefit in excess of $25,000 (Table I).

The operational appeal of this approach was increased with the thought that evaluating those five requests, or less than four percent of the total requests, might identify benefits

that amounted to more than twice the cost ($53,766) of providing assistance services during the fourth quarter of FY-76.

At the time the evaluation of those five requests was ready to begin, the expanded FESO Automated Information System was ready to be tested with live data. Rather than wait to obtain data from evaluating the "larger" benefit requests, six requests which had been evaluated by the EFD RDT&E liaison engineers were chosen so as to provide a variety of data for test purposes. The total benefit from these six requests was determined to be $46,828, or 87 percent of the cost of the Assistance Program.

As testing of the expanded information system continued, and again without concentrating on the "larger" benefit requests, the number of evaluated requests included in the data base was increased from six to ten. Three more requests evaluated by the EFD representatives were added, and one request evaluated by the author. These four included one request which had been evaluated as a duplicate, and therefore of zero benefit. The total benefit of these ten requests amounted to $54,428. Thus identified benefits from approximately seven percent of the total requests, had exceeded the cost of the program. In addition, the identified benefit of nine of these requests was in the range of potential benefit as ranked by the author. The results of these ten evaluations are shown in Table II.

Although the results were encouraging, serious doubts were forming as to their credibility and usefulness to management. There would be some who would question the approach.

TABLE I

SUBJECTIVE RANKING OF ASSISTANCE REQUESTS

Benefit Estimate Code	Range of Estimated Potential Benefit ($)	Number of Requests	Percentage of Total
1	0	25	17
2	0 - 499	19	13
3	500 - 4999	73	50
4	5000 - 24999	18	12
5	Over - 25000	5	4
6 (Duplicate)	0	5	4
	TOTAL	145	100

TABLE II

BENEFITS OF FIRST TEN ASSISTANCE REQUESTS

	Request Number	Benefit Estimate Code	Benefit ($)
First Six	557	1	0
	643	4	23,862
	647	1	0
	682	4	20,000
	688	3	716
	720	3	2,258
Next Four	559	3	6,000
	587	6	0
	588	3	0
	715	3	1,600
		TOTAL	54,428

Therefore, the direction of the study was modified and the scope expanded to overcome potential barriers to future use.

The direction was changed to determine what level of benefit had been achieved, stated in terms of ROI.

D. RANDOM SAMPLING APPROACH

In this approach, requests were randomly selected, evaluated, and their individual benefits aggregated and used as a basis for estimating the total benefit of all requests received. The estimated total benefit was then divided by the total investment in the Assistance Program to determine an estimated ROI. The aim was to achieve significant results with the minimum size sample, so that evaluation efforts in an on-going system could be maintained at a manageable level. Somewhat arbitrarily, although based on results to that point in the study, a ten percent sample size was selected. With a sampling population of 115 requests, the sample consisted of 12.

A multiple group sampling procedure using three separate sample groups of four requests each, with replacement taking place before each new group was selected, was chosen as the most appropriate procedure for this sample size. The premise was that the mean and standard deviation of the sample group means would provide the best estimate of the mean of the population of requests sampled.

The SPSS provides a procedure for taking a random sample from a file (population) for processing. A factor is selected which is a positive number less than 1.0 which indicates the

percentage of the file that is to be analyzed. For instance, a factor of 0.1 would result in approximately a 10 percent sample for the entire file. The probability of selecting any particular request in the file is equal to the factor specified. However, as each request is considered for selection independently of all other requests, the resulting set of sampled requests will generally not be exactly the size specified. The sample procedure used by SPSS is set up in such a way that a different random sample will be selected each time the user requests a sample [Ref. 10].

A factor of 0.033 was selected to obtain the three groups of four requests each for a series of multiple sampling. However, rather than obtaining this grouping, the SPSS procedure consistently provided samples containing three, two, and five requests. Repeated attempts to obtain three or more equal size samples proved fruitless and efforts to use the SPSS sample procedure were abandoned.

Using the random number generator program in an HP-25 programmable hand-calculator, three groups of four requests each were selected. Field evaluations via telephone interviews were performed by the author for those selected requests not already evaluated by the EFD RDT&E liaison engineers. The resulting mean of the mean benefit of these three sample groups was $12,134, with a standard deviation of $9,607. Although the benefit values of individual requests are assumed to be normally distributed, the sampling distribution was probably not normal since the sample size

was small (less than 30). Accordingly, the student's "t" distribution for small sized samples was used [Ref. 11]. The 95% confidence interval of the mean benefit was determined to range between -$11,734 and $36,002. The corresponding range of total benefit for the population of 115 requests was from -$1,349,410 to $4,140,230. Thus the estimated range of ROI was between -25 and 77 with a confidence of 95%.

A review of these figures in the light of the benefits already identified spoke for the need to seek a narrower confidence interval.

Another set of requests was randomly selected to comprise the fourth sample group. Again, missing evaluations were obtained from telephone interviews. The sample then consisted of 16 requests, divided into four groups. The resulting mean of the mean benefit shifted to the left and the confidence interval was narrowed somewhat, although it was still not definitive since the lower limit remained negative. The resultant range of ROI was -11 to 52.

The number of sample groups was increased again, to five, in an attempt to gain further narrowing. The process of randomly selecting another group of four requests, obtaining missing evaluations and performing the necessary calculations was repeated as above. The results were encouraging in that the range of ROI did narrow further, although the left end remained negative. The results of these three sampling trials are shown in Table III.

TABLE III

ESTIMATED TOTAL BENEFIT BY MULTIPLE GROUP SAMPLING

	Limits of 95% Confidence Interval			
	LIMIT	BENEFIT		
		$\overline{X}$ ($)	TOTAL ($)*	ROI
Trial No. 1				
3 groups of 4 requests each —				
$\overline{X}$ = $12,234	Lower	-11,374	-1,349,410	-25
$\hat{S}$ = $9,607	Upper	36,002	4,140,230	77
Trial No. 2				
4 groups of 4 requests each —				
$\overline{X}$ = $9,639	Lower	-5,152	-592,480	-11
$\hat{S}$ = $9,297	Upper	24,430	2,809,450	52
Trial No. 3				
5 groups of 4 requests each —				
$\overline{X}$ = $8,641	Lower	-2,055	-236,325	-4
$\hat{S}$ = $8,471	Upper	18,977	2,182,355	41

* for 115 requests

where $\overline{X}$ = mean benefit

$\hat{S}$ = sample standard deviation

At this point it was tentatively concluded that the difficulty in obtaining a fairly narrow and definitive range of estimated total benefit was mainly due to the small number of sample groups and the wide range in value of individual benefits. It was believed that these complications would not be present, or at least not to the same degree, in on-going evaluations with a larger sample population.

A similar situation, in which a wide range of individual benefits is fixed, but the sample size can be effectively increased, exists in the manufacturing industry, where inspection of entire lots of goods is too expensive. Sampling inspection by attributes is used with the intent of achieving the desired type of control information with the smallest possible sample. In an attempt to reduce the total amount of inspection required, sequential sampling is used. This procedure consists of inspecting one item at a time, or one group of items at a time, and after each inspection determining whether the accumulated information from items thus far inspected justifies a decision concerning acceptance or rejection of the lot, or whether another item or group of items must be inspected. A judgement concerning the whole lot is made on the basis of the combined samples [Refs. 12 and 13]. In attribute inspection applied to manufacturing, upper and lower acceptance limits are established for defective items as the basis for an accept or reject decision. In this study, where the attributes are benefits, an "acceptable" range was achieved when the upper and lower confidence

limits were both positive. This amounts to rejecting the situation where a large isolated benefit or a significant number of zero benefits produce non-definitive results. An acceptable range may still be fairly wide, although evaluation of additional groups will narrow the range further.

Grouped sequential sampling was chosen so that results could be compared with those previously obtained from multiple group sampling. Specifically, a fourth trial was run with the evaluated benefits of the four requests in the first group of the multiple group sampling procedure used to calculate estimated total benefit. If the sample were sufficiently convincing, a decision could be made about the entire program at that point. Previous results did not indicate that this would be so, although it might be in future evaluations. Accordingly a fifth and sixth trial group were tested using combined samples of eight and 12 requests. At that point duplicate requests appeared in the random sample groups which had the effect of reducing the combined samples for the seventh and eighth trials to 15 and 18 requests.

One more possible test of this procedure existed. A total of 45 requests had been evaluated at that time by the EFD RDT&E liaison engineers and the author. These did not include any duplicate requests or those ranked in the "zero" benefit range, which were excluded from the random sampling approach. The ninth trial consisted of testing these 45 requests as one sample to see whether a narrower range of estimated total benefit would result. This was a biased trial, although the

inaccuracy was believed to be minimal since 40 percent of the requests had been randomly selected. Also, since the sample of 45 requests represented 39 percent of the total of 115 requests in the population, it should produce a fairly reliable estimate of total benefit. The results of the six grouped sequential sampling trials are shown in Table IV.

The identified benefits of the 18 requests in Trial No. 8 amounted to $145,844 and the identified benefits of the 45 requests in Trial No. 9 totaled $324,019. These values provided sufficient evidence to conclude that it was feasible to obtain meaningful ranges of estimated total benefit with a random sampling approach, and no further attempts were made to narrow the range. At that point it had been determined that the estimated ROI for the Assistance Program, during the fourth quarter of FY-76, would fall within a range between seven and 24, with a confidence of 95 percent.

Several significant differences were apparent from a comparison of the results from grouped sequential sampling with those from multiple group sampling:

1. The range of estimated total benefit was wider with multiple group sampling, and although it narrowed faster and more uniformly than with grouped sequential sampling, the lower limit remained negative after benefits of 16 percent of the requests had been included in the samples.

2. The range of estimated total benefit was consistently narrower with grouped sequential sampling, and the lower limit became positive by the time benefits of seven percent of the

TABLE IV

ESTIMATED TOTAL BENEFIT BY GROUPED SEQUENTIAL SAMPLING

	Limits of 95% Confidence Interval			
	LIMIT	BENEFIT		
		$\overline{X}$ ($)	TOTAL ($)*	ROI
Trial No. 4				
4 requests —				
$\overline{X}$ = $2,383	Lower	-3,218	-370,116	-7
$\hat{S}$ = $4,035	Upper	7,983	918,045	17
Trial No. 5				
8 requests —				
$\overline{X}$ = $11,987	Lower	2,626	301,967	6
$\hat{S}$ = $11,482	Upper	21,347	2,454,951	46
Trial No. 6				
12 requests —				
$\overline{X}$ = $12,134	Lower	3,682	423,419	8
$\hat{S}$ = $13,437	Upper	20,586	2,367,355	44

* for 115 requests

where $\overline{X}$ = mean benefit

$\hat{S}$ = sample standard deviation

TABLE IV (Continued)

ESTIMATED TOTAL BENEFIT BY GROUPED SEQUENTIAL SAMPLING

	Limits of 95% Confidence Interval			
	LIMIT	BENEFIT		
		$\overline{X}$ ($)	TOTAL ($)*	ROI
Trial No. 7				
15 requests —				
$\overline{X}$ = $9,723	Lower	2,618	301,070	6
$\hat{S}$ = $12,914	Upper	16,828	1,935,220	36
Trial No. 8				
18 requests —				
$\overline{X}$ = $8,102	Lower	1,986	228,424	4
$\hat{S}$ = $12,298	Upper	14,218	1,635,070	30
Trial No. 9				
45 request —				
$\overline{X}$ = $7,200	Lower	3,056	351,440	7
$\hat{S}$ = $14,183	Upper	11,344	1,304,560	24

* for 115 requests

where $\overline{X}$ = mean benefit

$\hat{S}$ = sample standard deviation

requests had been included in the sample group, although the range was still quite wide.

The results of the nine random sampling trials are shown graphically in Figure 4 for comparative purposes. Since the calculations of statistics were performed external to SPSS, using an HP-25 programmable calculator, the procedures were not included in the modified FESO Automated Information System. However, typical calculations are included in Appendix F.

E. ESTIMATING APPROACH

With the knowledge that a random sampling approach would produce meaningful benefit information for management use, the possible value of subjectively ranking requests into ranges of estimated potential benefit was explored further. By multiplying the number of requests in each range by the mid-value of that range, and summing these range totals, an estimate of total benefit could be obtained. Since the mid-value of the "over $25,000" range was unknown, the value of $25,000 was arbitrarily assumed. Performing these calculations resulted in an estimated total benefit of $600,500 (Table V). The value was well situated within the 95 percent confidence limits of from $351,440 to $1,304,560 obtained in sampling Trial No. 9. Actually, it was conservative as it was 38 percent below the mid-point value of $828,000.

An opportunity existed to see how conservative the benefit estimating approach was, by comparing it with the identified benefits of the 45 requests included in Trial No. 9. Using those 45 requests, the procedure described above was repeated.

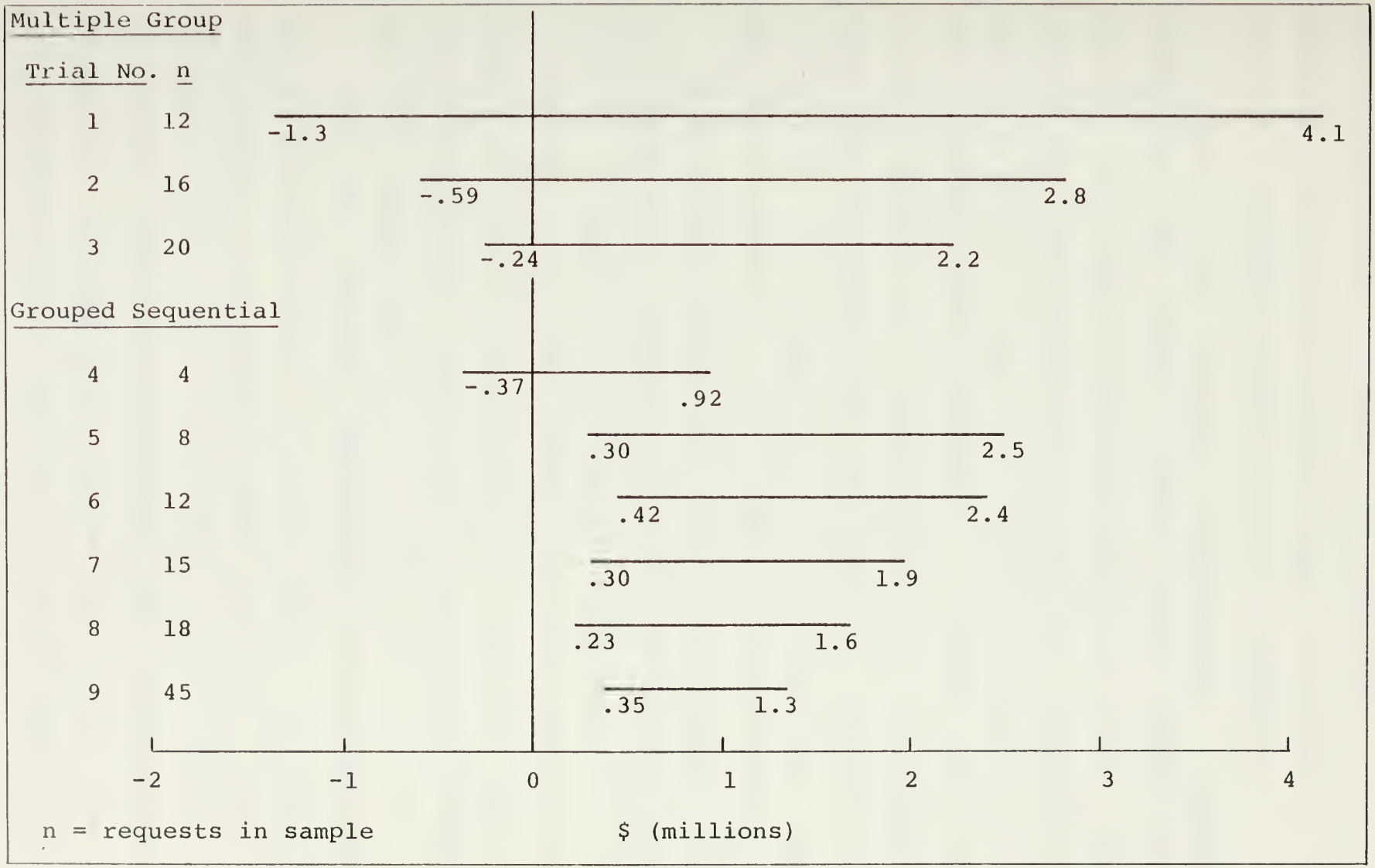

Figure 4 The 95% Confidence Intervals for Total Benefit for Nine Sampling Trials

The estimated total benefit was calculated to be $263,508, compared to the identified total benefit of $324,017. The estimating approach was conservative by 19 percent.

A review of the individual benefits of the 45 requests showed that three requests produced benefits greater than $25,000. The values of these benefits were $75,165, $39,770, and $30,000. Their mean value was $48,312. Using $48,000 for the mid-value of the "over $25,000" range should increase the reliability of the estimate since it would then be based on actual benefit data. Recalculating the total benefit using this revised mid-value resulted in an estimated value of $715,500. This value was closer to the mid-point value of $828,000 from Trial No. 9, but still 14 percent below it.

Using $48,000 for the mid-value of the "largest" range and repeating the comparison with the 45 evaluated requests in Trial No. 9 resulted in an estimated total benefit of $332,500. A difference of only three percent from the identified total benefit of $324,017 was accepted as an indication that the estimating approach, as practiced by the author, had been successfully demonstrated to be reasonably accurate.

After that successful demonstration, an estimate of total benefit was made based on the actual benefit that had been identified and the estimated benefit remaining in the 70 requests that had not been evaluated. The results of these calculations indicated an estimated total benefit of $707,017 (Table VI). Although this value was very close to the original estimated value of $715,500, it was not taken as an

TABLE V

ORIGINAL ESTIMATE OF TOTAL BENEFIT

Range of Estimated Potential Benefit ($)	Mid-value of Range ($)	Number of Requests	Estimated Benefit ($)
0	0	30	0
0 - 499	250	19	4750
500 - 4999	2750	73	200750
5000 - 24999	15000	18	270000
over 25000	25000	5	125000
	TOTAL	145	600500

TABLE VI

ESTIMATE OF TOTAL BENEFIT BASED ON EVALUATED BENEFIT

Range of Estimated Potential Benefit ($)	Mid-value of range	Number of Requests	Estimated Benefit ($)
0	0	30	0
0 - 499	250	9	2250
500 - 4999	2750	49	134750
5000 - 24999	15000	10	150000
over 25000	48000	2	96000
	SUBTOTALS	70	383000
EVALUATED REQUESTS		45	324017
	TOTALS	115	707,017

indication that these estimates of total benefit were any better than those obtained by the grouped sequential sampling procedure. What was apparent, was that the estimating approach provided another valuable tool for the FESO to use in estimating total benefit with reasonably accuracy. For this reason, procedures were incorporated into the expanded FESO Automated Information System to facilitate these calculations. These procedures, along with other system modifications are discussed in section VI.

VI. EXPANSION OF THE FESO AUTOMATED INFORMATION SYSTEM

Using the Statistical Package for the Social Sciences (SPSS), an automated information system was developed and demonstrated by Suess and Thaler [Ref. 9]. It has since been implemented to satisfy the data processing requirements of the FESO using the Lawrence Berkeley Computing Center via a batch terminal.

Since the gathering and processing of information on the benefits of assistance requests will be an on-going requirement for the FESO, it was a logical next step to accommodate by expanding the FESO Automated Information System. The expansion of the system to satisfy the information requirements of an effectiveness measuring system is discussed in the remainder of this section.

A. STATEMENT OF SYSTEM OBJECTIVES

The major objectives in expanding the FESO Automated Information System are:

1. To relieve the FESO of as much time-consuming manual data manipulation as possible.

2. To provide a method to process benefit information on any or all requests received during any or all quarters of a fiscal year.

3. To provide a method to verify automatically the accuracy of the data input to the computer.

4. To accurately process and generate all of the benefit information required by the FESO in preparing effectiveness reports.

B. IDENTIFY OUTPUT REPORTS

The initial step in expanding the system was to identify required output reports. To ensure adequate identification for control purposes, each output report was given a descriptive title and assigned a report number.

Previous efforts had identified eleven reports as being necessary to provide the FESO with the information to function effectively. Eleven additional reports relating to benefit information were identified as being necessary and were given individual designators. An inventory of these reports is included in Figure 5.

C. PREPARE REPORT SPECIFICATIONS

After the output reports had been identified, input and data manipulation required to produce the output reports were determined. This was done by preparing a Report Specification for each output report listed in the Inventory of Reports. Preparation of the Report Specifications required a detailed systematic analysis of each output report to determine the data selection criteria, data elements, data manipulation logic and output parameters. The report specifications for the eleven benefit reports are included in Appendix G. The information contained in the report specifications of the benefit portion of the information system was used to prepare the SPSS control cards and operating procedures described later.

INVENTORY OF BENEFIT REPORTS

Report No.	
0B	Benefit Edit Report
12	Original Estimate of Total Benefit
13	Breakdown of Evaluation Status
14	Breakdown of Field Evaluation Data
15	Comparison of Contribution and Information Provided
16	Summary of Savings by Type of Savings
17	Estimated Minimum Benefit of Evaluated Requests
18	Summary of Evaluated Benefits by Type of Savings
18A	Statistics for Evaluated Benefits
19	Summary of Benefits by Benefit Code
20	Estimated Minimum Remaining Benefit by Benefit Estimate
21	Comparison of Benefit Estimate and Benefit

Figure 5. Inventory of Benefit Reports

D. COMPILE DATA ELEMENT LIST AND ASSIGN CODES

With the report specifications prepared, the requirements for the data input became apparent. A review of the report specifications provided a composite list of all data elements that should be included as input to the preparation of the reports. A list of all data elements used in the benefit portion of the information system is shown in Figure 6.

E. DESIGN INPUT RECORD FORMAT AND CODE DATA DEFINITION

The structuring of the data elements followed from the format of the questionnaire (input record). Figure 7 shows the format of the input record for assistance benefit information. Fields 1 through 4 comprise the control group and are identical to those previously used, as in Field 5. Field 5 is a special type field. It is a redefinition or combination of fields 3 and 4. Fixed data comprise Fields 6 through 15 and 20 through 22. Fields 16 through 19 and 23 comprise the variable group.

With the input record format described, the additional data base was described in computer language utilizing the data definition language feature of the SPSS. This process entailed defining the data elements and their codes in the format specified in the SPSS Manual. The results of the preparation of data definition cards describing the expanded portion of the Assistance Program data base are listed in Appendix H. Cards which relate to the benefit portion of the data base, or required modifications to accommodate it, are preceded by a solid ball (•).

DATA ELEMENT LIST

Data Element	Number of Characters	Format
Evaluation	1	Numeric
Estimate of Benefit	1	Numeric
Any Benefit	1	Numeric
No Benefit	1	Numeric
Benefit Code	2	Numeric
Use of Advice or Assistance	2	Numeric
Use Factor	4	Numeric
Discounted Present Value Factor	5	Numeric
Type of Savings	1	Numeric
One-Time Construction or Repair Cost Savings	6	Numeric
Annual Maintenance Cost Savings	6	Numeric
Annual Operating Cost Savings	6	Numeric
Project Cost	7	Numeric
Contribution of Advice or Assistance to Decision	1	Numeric
Percent of Information Provided by CEL Compared to Total	3	Numeric
Would Solution be Applicable to Other Activities	1	Numeric
Benefit	6	Numeric

Figure 6. Data Element List

INPUT RECORD FORMAT FOR BENEFIT DATA

Input Field	Data Element Name	Variable Name	Number of Characters	Record Positions	Data Element Description
1	Fiscal Year	FY	2	1-2	Two digits stating Fiscal Year
2	Quarter	QTR	1	3	One digit indicating which of four quarters in the Fiscal Year the request was received
3	Program	PROGRAM	1	4	One digit, indicating type of program, energy or non-energy or non-energy supporting the request.
4	Serial Number	SERIAL	3	5-7	Three digit sequential number assigned upon receipt at CEL.
5	Control Number	CNTRLNR	4	4-7	Expanded code of program and control number.
6	Card Number	CARDNR	2	8-9	Two digits indicating number of card.
			2	10-11	(Reserved for future use)
7	Evaluation E	EVAL	1	12	One digit indicating whether and where evaluation was performed.

Figure 7. Input Record Format for Benefit Data
Page 1 of 4

INPUT RECORD FORMAT FOR BENEFIT DATA

Input Field	Data Element Name	Variable Name	Number of Characters	Record Positions	Data Element Description
8	Estimate of Benefit	BNFTEST	1	13	One digit indicating range of estimated potential benefit.
9	Any Benefit	ANYBNFT	1	14	One digit indicating whether assistance was of benefit.
10	No Benefit	NO BNFT	1	15	One digit indicating why assistance was not of benefit.
11	Benefit Code	BNFTCOD	2	16-17	Two-digit code indicating category of benefit.
12	Use of Advise of Assistance	USE	2	18-19	Two-digit code indicating degree of implementation of information provided by CEL.
13	Use Factor	USEFACTR	4	20-23	Three-digit decimal factor representing probability of implementation.
14	Discounted Present Value Factor	PV	5	24-28	Four-digit decimal factor representing discounted present value factor.
15	Type of Savings	TYPSAV	1	29	One-digit code indicating type of project savings.

Figure 7. Input Record Format for Benefit Data

INPUT RECORD FORMAT FOR BENEFIT DATA

Input Field	Data Element Name	Variable Name	Number of Characters	Record Positions	Data Element Description
16	One-Time Construction or Repair Cost Savings	ITMSAV	6	30-35	Up to six-digit number indicating amount of savings.
17	Annual Maintenance Cost Savings	AMSAV	6	36-41	Up to six-digit number indicating amount of savings.
18	Annual Operatins Cost Savings	ADSAV	6	42-47	Up to six-digit number indicating amount of of savings.
19	Project Cost	PRJCST	7	48-54	Up to seven-digit number indicating project value. Used in estimating benefit not directly estimable in dollar savings.
20	Contribution of Advice or Assistance To Decision	CONTRIB	1	55	Two-digit code indicating contribution of CEL information to overall decision.
21	Percent of Information Provided by CEL Compared to Total	INFO	3	56-58	Two or three digits representing percentage of information provided by CEL compared to total used to make decision.

Figure 7. Input Record Format for Benefit Data
Page 3 of 4

INPUT RECORD FORMAT FOR BENEFIT DATA

Input Field	Data Element Name	Variable Name	Number of Characters	Record Positions	Data Element Description
22	Would Solution be Applicable to Other Activities	OTHRUSE	1	59	One-digit code indicating whether solution to the problem would have application at other shore activities.
23	Benefit	BNFT	6	60-65	Up to six-digit number representing calculated benefit.

Figure 7. Input Record Format for Benefit Data

F. CONVERT REPORT SPECIFICATIONS INTO COMPUTER TASK DEFINITIONS

A set of task-definition cards was then prepared to describe the data manipulation and the statistical calculations to be performed on selected data for each report to be produced. The data-definition cards remain unchanged while preparing all reports. However, a set of task-definition cards is required for each report. Each set of cards was identified by using a TASK NAME statement card.

The report specification provided the information necessary to prepare the task-definition cards. The data selection constraints defined which data should be used. The data manipulation requirements defined which calculations were to be made. The task-definition logic for each of the benefit information reports developed for the Assistance Program are contained in Appendix I.

G. DEVELOP EDIT LOGIC

In developing the editing logic for the benefit portion of the Assistance Program data base, "sight" verification of the input data was implemented through the use of the activity file, a computer printout of all input data.

Prior to the processing of any reports, the input data was run through an edit operation. This edit operation was designed by the preparation of an additional set of task-definition statements. This set of task-definition statements checks each data record for accuracy in conformance with the coded data previously established on the data-definition

cards in the computer program. Figure 8 lists the set of task-definition statements prepared for the edit operation. The edit logic checks each field in the input record for accurate and complete data in two manners. First, the content of each field is checked against the data-definition section statements that defined the structured data base and accepted values. Each field must have an acceptable value or it is flagged as an error. Next the relationship between fields is defined and the content of the related fields must be consistent. For example, if for a particular request, the type of saving field has been coded "1," indicating that a one-time construction or repair savings has been realized, and there is no data in the one-time savings field, the edit logic will flag an error. If the record passes the edit without any error flags, the data are considered accurate and complete.

Error information about the data record that failed the edit test is displayed through the use of an exception report. Error flags showing the input card columns containing erroneous data are displayed in the report along with the necessary record identification information. When the erroneous data card records are corrected and all input data passes the edit with a "negative" exception report (no errors), processing of the reports may begin.

Artificial test data were contrived for the benefit portion of the information system to test the edit logic. Invalid data were constructed to test the comprehensiveness of the

```
COMMENT
COMMENT         ************************************************************
COMMENT
COMMENT         BEGIN EDIT REPORT = REPORT 0B
COMMENT
TASK NAME       EDIT REPORT - 0B
SELECT IF       (GROUP EQ 6)
*COMPUTE        ERROR1=1213
*COMPUTE        ERROR2=1617
*COMPUTE        ERROR3=1819
*COMPUTE        ERROR4=2954
*COMPUTE        ERROR5=2920
*COMPUTE        ERROR6=2956
*COMPUTE        ERROR7=2924
*COMPUTE        ERROR8=5555
*COMPUTE        COMP1=0
*IF             (EVAL EQ 0 OR 1 OR 2)ERROR1=0000
*IF             (EVAL EQ 2 AND BNFTEST EQ 1)ERROR1=0000
*SELECT IF      (ERROR1 EQ 1213)
*IF             (BNFTCOD EQ 00 OR 01 OR 02 OR 03 OR 04 OR 05 OR 06 OR 07 OR 08
                OR 09 OR 10 OR 11 OR 12 OR 13 OR 14 OR 15)ERROR2=0000
*SELECT IF      (ERROR2 EQ 1617)
*IF             (USE EQ 00 OR 11 OR 21 OR 22 OR 23 OR 31 OR 32
                OR 41 OR 51)ERROR3=0000
*SELECT IF      (ERROR3 EQ 1819)
*IF             (TYPSAV EQ 0 OR 1 OR 2 OR 3 OR 4 OR 5)ERROR4=0000
*IF             (TYPSAV EQ 1 AND ITMSAV EQ 0)ERROR4=2954
*IF             (TYPSAV EQ 2 AND AMSAV EQ 0)ERROR4=2954
*IF             (TYPSAV EQ 3 AND AUSAV EQ 0)ERROR4=2954
*IF             (TYPSAV EQ 4 AND PRJCST EQ 0)ERROR4=2954
```

Figure 8 Assistance Program Benefit Edit Logic - Report 0B

```
*SELECT IF      (ERROR4 EQ 2954)
*IF             (TYPSAV EQ 0 OR 1 OR 2 OR 3 OR 4 OR 5)ERROR5=0000
*IF             (TYPSAV EQ 1 AND USEFACTR EQ 0)ERROR5=2920
*IF             (TYPSAV EQ 2 AND USEFACTR EQ 0)ERROR5=2920
*IF             (TYPSAV EQ 3 AND USEFACTR EQ 0)ERROR5=2920
*IF             (TYPSAV EQ 4 AND USEFACTR EQ 0)ERROR5=2920
*SELECT IF      (ERROR5 EQ 2920)
*IF             (TYPSAV EQ 0 OR 1 OR 2 OR 3 OR 4 OR 5)ERROR6=0000
*IF             (TYPSAV EQ 1 AND INFO EQ 0)ERROR6=2956
*IF             (TYPSAV EQ 2 AND INFO EQ 0)ERROR6=2956
*IF             (TYPSAV EQ 3 AND INFO EQ 0)ERROR6=2956
*IF             (TYPSAV EQ 4 AND INFO EQ 0)ERROR6=2956
*SELECT IF      (ERROR6 EQ 2956)
*IF             (TYPSAV EQ 0 OR 1 OR 2 OR 3 OR 4 OR 5)ERROR7=0000
*IF             (TYPSAV EQ 2 AND PV EQ 0)ERROR7=2924
*IF             (TYPSAV EQ 3 AND PV EQ 0)ERROR7=2924
*SELECT IF      (ERROR7 EQ 2924)
*IF             (CONTRIB EQ 0 OR 1 OR 2 OR 3 OR 4)ERROR8=0000
*SELECT IF      (ERROR8 EQ 5555)
LIST CASES      CASES=200/VARIABLES=FY,CNTRLNR,ERROR1,ERROR2,ERROR3,
                ERROR4,ERROR5,ERROR6,ERROR7,ERROR8
FREQUENCIES     GENERAL=CNTRLNR
COMMENT
COMMENT         END EDIT REPORT = REPORT 0B
COMMENT
COMMENT         ************************************************************
COMMENT
```

Figure 8 Assistance Program Benefit Edit Logic - Report 0B

edit logic. After successfully passing this test, representative live data were prepared and used as input to test each report separately. After each report processing logic was tested separately, a system test was conducted using live data and generating all benefit reports.

The test reports prepared for the benefit portion of the Assistance Program data base provided some interesting results which were discussed in section V. To illustrate a typical test report, the test report used as a basis for Table II is shown in Figure 9. The reason that Table II lists ten requests, while Figure 9 lists only seven, is that three of the requests were ranked as "zero" benefit requests which excluded them from field evaluations.

CASE-NO	CNTRLNR	BNFTEST	BNFTCOD	TYPSAV	BNFT
1	559.	3.	8.	4.	6000.
2	588.	3.	13.	5.	0
3	643.	4.	1.	2.	23862.
4	682.	4.	1.	1.	20000.
5	688.	3.	1.	2.	716.
6	715.	3.	8.	4.	1600.
7	726.	3.	7.	4.	2250.

- - - - - - - - - - - - - - - - - DESCRIPTION OF SUBPOPULATIONS - - - - - - - - - - - - - - -

CRITERION VARIABLE BNFT BENEFIT
BROKEN DOWN BY TYPSAV TYPE OF SAVING

- -

VARIABLE	CODE	VALUE LABEL	SUM	MEAN	STD DEV	VARIANCE	N
FOR ENTIRE POPULATION			54426.0000	7775.4286	9919.0824	.98388E+08	(7)
TYPSAV	1.	SAVINGS IN ONE TIME	20000.0000	20000.0000	0	0	(1)
TYPSAV	2.	SAVINGS IN ANNUAL MA	24576.0000	12288.0000	16366.6936	.26786E+09	(2)
TYPSAV	4.	NOT ESTIMABLE	9850.0000	3283.3333	2375.0439	5640833.3333	(3)
TYPSAV	5.	OTHER	0	0	0	0	(1)

TOTAL CASES = 7

Figure 9 Test Report - Summary of Evaluated Benefits By Type of Savings - Report #18

VII. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

The arguments for and the demonstration of the use of two conceptually different approaches to satisfy NAVFAC management requirements to measure the effectiveness of a small service program have been presented in this study. The following conclusions have been drawn.

1. The data resulting from user evaluations of randomly selected assistance requests, when processed by a computer-aided information system is a viable and economically affordable basis for estimating the return on investment of the resources expended on the Assistance Program.

2. Grouped sequential sampling procedures produced meaningful ranges of estimated total benefit for requests received during the fourth quarter of FY-76. The total benefit for that period was estimated to be between $350,000 and $1,300,000, which corresponded to a return on investment between seven and 24, with a confidence of 95 percent.

3. The Assistance Program produced an acceptable level of benefit during the fourth quarter of FY-76. Benefits quantified in this study amounted to $324,017, or a return on investment of six.

4. An estimating approach based on subjectively ranking requests into ranges of potential benefit is a valuable tool for the FESO to use in estimating total benefit of the Assistance Program with reasonable accuracy. Using this approach,

the total benefit of the Assistance Program during the fourth quarter of FY-76 was estimated to be $710,000, or a return on investment of 13.

B. RECOMMENDATIONS

1. Each request should be subjectively ranked by the FESO into one of two categories; those containing "zero" benefit, and those with potentially measurable benefit. "Zero" benefit requests should be excluded from further evaluation.

2. An effectiveness measuring system, using a random sampling approach as presented in this study, should be adopted by the FESO for measuring the effectiveness of the Assistance Program during FY-77.

3. Evaluation data for selected requests should be obtained from field users, using the feedback questionnaire developed as part of this study. Requests originating from the EFDs should be administered by the EFD RDT&E liaison engineers. The FESO should administer the evaluation of all other selected requests.

4. Four groups of four requests each should be selected from each of the four quarters of FY-77, which should approximate a ten percent sample. Evaluation data from these requests should be used to calculate estimated total benefit and return on investment using procedures for multiple group sampling, grouped sequential sampling, and then request-by-request sequential sampling as the basis for selecting a single sampling plan and an appropriate sample size for on-going effectiveness measurements.

5. Additional work should be undertaken by the FESO to locate or develop procedures for selecting sample groups and programs to perform the necessary statistical calculations for the selected sampling procedure which are compatible with the SPSS, or can be incorporated into the FESO Automated Information System.

APPENDIX A

CURRENT PERFORMANCE MEASUREMENTS

In 1971, the FESO initiated measurements to gauge the activity of the Assistance Program and its usage by field personnel. The Assistance Program is currently measured by parameters, which are indicators of activity, rather than effectiveness. For the most part, they measure level of effort or input, rather than output.

A. NUMBER OF REQUESTS

The number of requests measurement is simply a count of the individual assistance requests received from personnel located at shore activities. This is one of the two primary measures used to gauge usage of the Assistance Program. A 222 percent increase in usage over the six years that measurements have been made is encouraging. The results of these measurements are shown in Figure 10. During the fourth quarter of FY-76, 145 requests were received from shore activities.

B. NUMBER OF ACTIVITIES

The number of activities measurement is a count of the individual activities whose personnel have requested assistance. This is the other primary measure for evaluating usage of the program. These two measure were selected and are used together, because it is felt that it is better, in terms of value to the Navy, to receive one request from each of ten activities, than ten requests from one activity. The magnitude

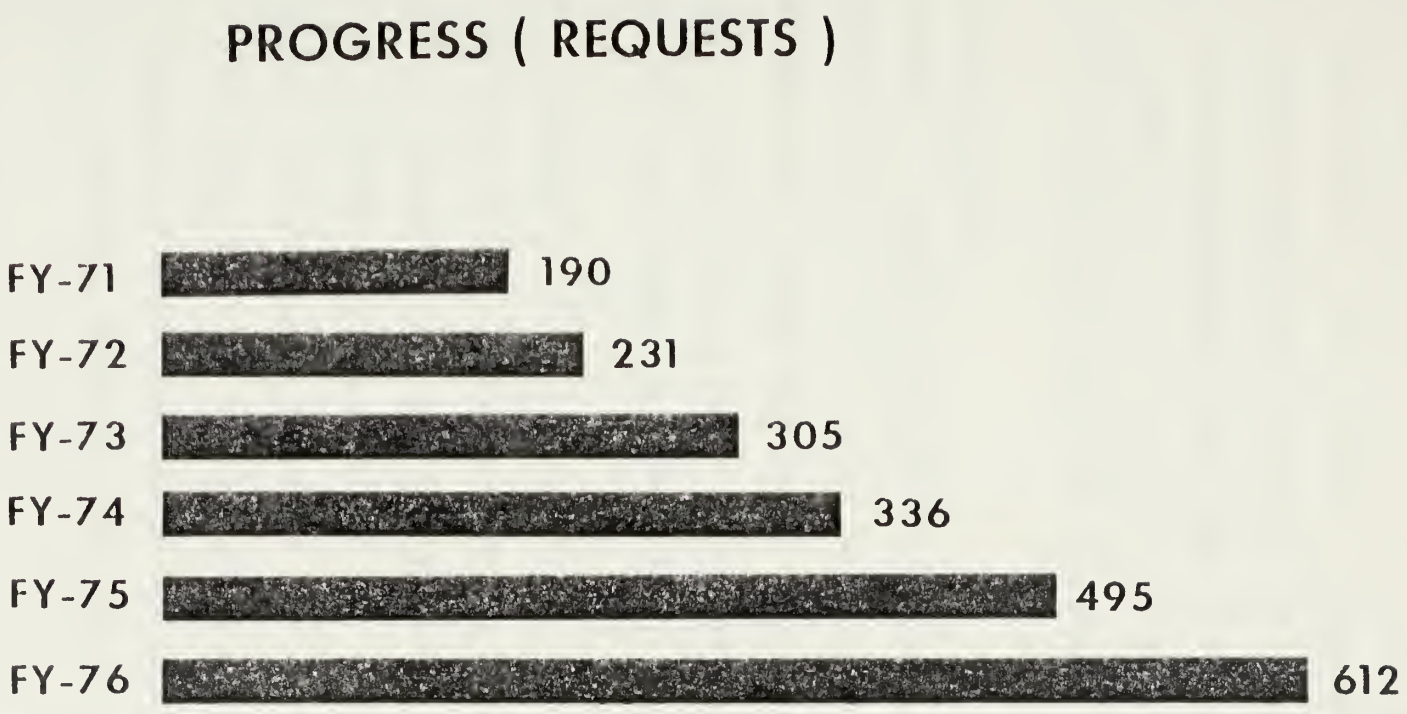

Figure 10 Number of Assistance Requests

of the number of activities count is smaller than the number of requests, simply because there are more people than there are shore activities. A 155 percent increase in usage, over the same six-year measuring period, is also encouraging. The results of these measurements are shown in Figure 11. During the fourth quarter of FY-76, requests were received from personnel at 78 individual shore activities.

C. SOURCE OF REQUESTS

The source of requests measurement categorizes the number of requests received by the type of organization that the individual requestor represents. The source of requests by type of organization for requests received during the fourth quarter of FY-76 are shown in Figure 12.

D. METHOD OF REQUEST

The method of receipt categorizes the method by which the individual requests were initially received by CEL personnel. Information on the method of receipt for requests received during the fourth quarter of FY-76 is shown in Figure 13. The fact that 88 percent of the requests were initially received by telephone is an encouraging acceptance of CEL's philosophy that it should be easily reached by telephone.

E. SUBJECT OF REQUESTS

The subject of requests measurement is a categorization of the number of requests received into broad subject categories. This measurement is expressed as a percentage and

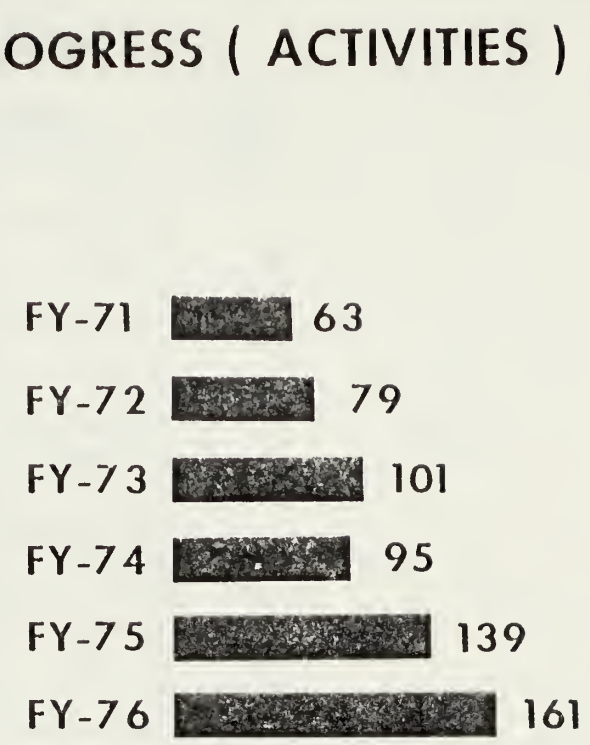

Figure 11 Number of Activities Requesting Assistance

* CROSSTABULATION

REQUEST REQUESTOR BY GROUP

* *

		GROUP	
	COUNT	SHORE FACILITY	ROW TOTAL
REQUEST		6	
	10	2	2
CNM			1.4
	20	5	5
NAVFAC			3.4
	30	41	41
EFD			28.3
	40	11	11
PWC			7.6
	50	70	70
STATIONS			48.3
	60	16	16
OICC AND ROICC			11.0
	COLUMN TOTAL	145 100.0	145 100.0

Figure 12 Summary of Requests by Major Requestor - Report #4

MEDIUMIN MEDIUM IN

CATEGORY LABEL	CODE	ABSOLUTE FREQUENCY	RELATIVE FREQUENCY (PERCENT)	ADJUSTED FREQUENCY (PERCENT)	CUMULATIVE ADJ FREQ (PERCENT)
LETTER	1	12	8.3	8.3	8.3
MESSAGE	2	2	1.4	1.4	9.7
TELEPHONE	3	128	88.3	88.3	97.9
VISIT TO SITE	4	3	2.1	2.1	100.0
	TOTAL	145	100.0	100.0	

VALID CASES 145 MISSING CASES 0

Figure 13 Method of Receiving Requests - Report #3

tends to illustrate that the full breadth of CEL's capabilities are employed in providing these services to shore activities. The subjects of requests received during the fourth quarter FY-76 are shown in Figure 14.

F. RESPONSE TIME

The response time measurement is simply a count of the calendar days that elapse after receipt of a request by CEL, until it is satisfied. This measure is the only one that approaches a measurement of output--timeliness of response. The results of this measurement for requests received during the fourth quarter FY-76 are shown in Figure 15. This is a display of the elapsed time to satisfy a request by the number of requests satisfied within that period of time. The fact that 72 percent of the requests received during the fourth quarter were satisfied within seven calendar days speaks well of the capability of CEL personnel to respond to field needs in a timely manner.

These measurements are useful in that they indicate an active and growing program, but with one exception they suffer from the disadvantage of measuring effort. Additional parameters, that provide meaningful measures of output and benefit are now required.

One current shortcoming in the administration of the Assistance Program is the lack of organized feedback from its users. An effectiveness measuring system will provide a limited amount of feedback information, but on a continuing basis.

SUBCAT2 MAJOR SUBJECT CATEGORY

CATEGORY LABEL	CODE	ABSOLUTE FREQUENCY	RELATIVE FREQUENCY (PERCENT)	ADJUSTED FREQUENCY (PERCENT)	CUMULATIVE ADJ FREQ (PERCENT)
BUILDING MATERIALS	11	20	13.8	13.8	13.8
CATHODIC PROTECTION	12	2	1.4	1.4	15.2
CORROSION	13	4	2.8	2.8	17.9
ENERGY	14	17	11.7	11.7	29.7
MECHANICAL EQUIPMENT	16	2	1.4	1.4	31.0
PAINTS,COATGS,CHEM	18	42	29.0	29.0	60.0
PAVEMENTS	19	11	7.6	7.6	67.6
POLLUTION	20	3	2.1	2.1	69.7
PHYSICAL SECURITY	21	5	3.4	3.4	73.1
ROOFING	23	13	9.0	9.0	82.1
STRUCTURAL	24	6	4.1	4.1	86.2
UTILITIES	25	4	2.8	2.8	89.0
WATERFRONT	26	4	2.8	2.8	91.7
FLOORING	27	3	2.1	2.1	93.8
OTHER	99	9	6.2	6.2	100.0
	TOTAL	145	100.0	100.0	

VALID CASES 145 MISSING CASES 0

Figure 14 Breakdown of Subjects of Requests - Report #2

* CROSSTABULATION OF * * * * * * * *
RESPONSE REQUEST RESPONSE TIME BY ITSELF
* *

RESPONSE / ITSELF — COUNT	1	2	7	14	30	31	32	ROW TOTAL
1 ZERO DAYS	58	0	0	0	0	0	0	58
								40.0
2 1 TO 2 DAYS	0	17	0	0	0	0	0	17
								11.7
7 3 TO 7 DAYS	0	0	30	0	0	0	0	30
								20.7
14 TO 14 DAYS	0	0	0	4	0	0	0	4
								2.8
30 TO 30 DAYS	0	0	0	0	17	0	0	17
								11.7
31 OVER 30 DAYS	0	0	0	0	0	10	0	10
								6.9
32 NOT ANSWERED	0	0	0	0	0	0	9	9
								6.2
COLUMN TOTAL	58	17	30	4	17	10	9	145
	40.0	11.7	20.7	2.8	11.7	6.9	6.2	100.0

Figure 15 Response Time - Report #1

This information will be useful in guiding and improving the program and expanding the potential for multiple use of certain successful applications of research results.

APPENDIX B

ADDITIONAL BENEFITS OF THE ASSISTANCE PROGRAM

The benefits of the Assistance Program are many and varied, and personnel at CEL and shore activities both share in these benefits. Since this study dealt only with those benefits that could be measured to some quantitative degree, it was considered important to list them so that they will not be overlooked and forgotten. Some of the additional benefits of the Assistance Program are that it:

- Promotes two-way communication and hence better understanding between laboratory and field personnel.
- Accelerates the diffusion and adoption of new knowledge.
- Provides valuable contact for laboratory personnel with actual field problems. Often this is "hands-on" experience gained when a site visit is required.
- Identifies actual field needs that would be amenable to solution through the R&D process.
- Provides feedback information to those involved in the R&D process, which serves to guide the direction of the research program toward efforts related to common field needs, the solution of which would have far-reaching impact. Although there was no attempt made to assess the value of this benefit, there is little doubt that it exists. Some future effort might attempt to evaluate the increased effectiveness of a research program as a result of having better knowledge of the actual needs of the end users of the research. For instance, an improvement of between one and two percent of CEL's program would offset the annual cost of the Assistance Program.
- Provides information not otherwise available to field personnel.
- Saves the time of field personnel who can avoid searching for information via literature searches and technical reports.

- Avoids the selection of some less than optimum alternatives by field personnel.

- Provides CEL researchers with the potential for almost instant job satisfaction through participation in the immediate solution of actual field problems.

APPENDIX C

CRITERIA FOR INPUT TO AND PERFORMANCE OF THE EVALUATION PROCESS

A. INPUT CRITERIA

Before proceeding with the development of a system model to relate individual evaluations to an effectiveness determination, some criteria had to be established to guide the evaluation effort. Since the procedures attempt to measure benefit to users, the users must be involved, but not to the extent that they will view CEL, its personnel, or the evaluation system as a threat to themselves or to their organization. Nor should they be made to feel that the effort is a busy, self-serving one on the part of CEL.

For example, there is little value in asking a person questions related to the benefit of the response to a particular request, when an experienced decision maker could subjectively estimate that little if any quantifiable benefit resulted from the exchange of information between CEL and field personnel. Again, this is not to say that the exchange did not provide benefit. It is only a realization that quantification of some benefits is not yet possible. If it can be judged with reasonable certainty that an assessment of benefit in quantitative terms would be difficult, if not impossible, why ask the field requestor for confirmation? Such tactics could be interpreted as a threat to the requestor if he thought that each request to CEL for assistance would be followed by an evaluation of

the benefit of the response he received. It might be easier to forego asking for assistance. In short, requests ranked by the FESO as containing "zero" benefit should not be evaluated in the field.

The procedures should also involve the laboratory engineers and scientists who provide the assistance, but not to the extent that they would view the evaluation effort as unnecessary or as requiring an inordinate amount of their time. The responsibility for reporting a significant part of the total assistance activity, those requests which are initially received by telephone, rests with the research personnel. If the evaluation effort reached the point where it consumed an inordinate amount of time, in relation to that which was required to provide the assistance, it could become easier to not report the assistance request and thereby automatically avoid any subsequent evaluation effort. The research personnel represent a resource that makes the Assistance Program possible, They should be protected and relieved, to the maximum extent possible, of any unnecessary administrative effort that detracts from their research tasks.

B. PERFORMANCE CRITERIA

The question of who should perform the evaluation of benefit of individual requests is tied strongly to a concern for the credibility of the results, the effort and expense required to perform evaluations, and the possibility of adverse effects on the overall program. The advantages and disadvantages of some of the methods considered are discussed below.

1. Evaluation by CEL Researchers

This method would have considerable appeal to some, at first, but there are several major disadvantages that preclude it from further serious consideration. Although it would be administratively easy to initiate, by issuing an instruction requiring evaluation of each assistance request, the possibility of creating adverse effects would be significant. Another disadvantage would be a complete lack of uniformity of the results. Still another disadvantage is the normal lack of credibility attached to self-evaluation.

2. Evaluation by Users

This method could involve automatically sending an evaluation questionnaire to each person or activity that requested assistance. The credibility of individual evaluations would probably be increased, but like evaluation by CEL researchers, the possibility of creating adverse effects would be significant. Also, the results from self-administered questionnaires would lack uniformity. In some cases they would not even be returned which would result in the collection of partial, and possibly useless, data. Because the quality of credibility should be strongest for data provided by users, their participation should be provided for in the final system, but with proper safeguards to ensure adequate data collection.

3. Evaluation by Contract

This would more than likely be the most expensive method in terms of dollar costs, while affording the least amount of control over the conduct of the evaluation effort.

Thus the risk of losing sight of the purpose for the evaluation and generating negative attitudes in the providers and users of the Assistance Program is high. Such results might be more believable to "outsiders," since the possible influence of self-evaluation would be removed, however, the results are primarily intended for internal NAVFAC and CEL use. Uniformity of results might be an advantage, but this would depend upon how the evaluation effort was staffed and conducted.

4. Evaluation by the FESO

Given that evaluations are to be performed, they could not be done by the FESO without any input from the users and CEL personnel. If they were, the results would be entirely subjective and would lack any degree of credibility. However, an evaluation effort coordinated and administered by the FESO has the advantage of decreasing the burden on the CEL research staff, providing a high degree of uniformity of data, and maintaining control over the introduction of factors that would result in negative attitudes being generated among users.

The method of having the evaluation efforts administered and coordinated by the FESO was selected for the effectiveness measuring model. With adequate input from the users and providers of assistance, this method provides the control necessary to ensure that sufficient information is provided to NAVFAC management, at an affordable price, and with the least disturbance to participants in the program.

APPENDIX D

DEVELOPMENT OF A MODIFIED EVALUATION PROCEDURE

A. MODIFICATION OF QUESTIONNAIRE MEASURING TECHNIQUE

As indicated earlier, the evaluation technique developed by Hendrickson and Fisher represented a breakthrough. The major input of data used as the basis for the analysis of the FY-74 assistance efforts was obtained through the use of a questionnaire which was revised from those used in earlier studies (Figure 16). A detailed review of the procedures and resulting data revealed that some additional information was gathered external to the questionnaire which necessitated some initial hand calculations prior to machine processing of the data. It was considered desirable to modify the questionnaire to avoid these external efforts, as discussed in the following section. The revised questionnaire used in this study is shown in Figure 17.

B. OPTIMIZING THE BASIC EVALUATION MODEL

The basic evaluation model developed by Hendrickson and Fisher quantifies in dollar terms the benefit of information provided by CEL in response to a specific request from a field user. The model is not subject to analytical analysis and proof, but the results therefrom do have intuitive appeal. A critical review by this author failed to reveal any shortcoming in the approach or logic, and it was decided to use the basic model, with slight modifications, to estimate the

FESO PROJECT EFFECTIVENESS QUESTIONNAIRE

1. Description of project: _____

_____

_____

2. Do you consider that the advice/assistance received was in any way beneficial? (If CEL contact led to another source of useful information, check yes and include that source in answering questions 4 through 7.)

_____(1) Yes _____(2) No

3. If no, why not? (Upon completion of this question, skip questions 4 through 7.) (check one)

_____(1) no reply received.
_____(2) lab could not provide expertise in this area.
_____(3) other. Please explain: _____

_____

4. Describe the degree of utilization of the advice and/or assistance. (check as many as are appropriate)

_____(1) directly implemented.
_____(2) direct implementation is planned
_____(3) test and evaluation of recommended solution is planned or underway.
_____(4) more extensive research on proposed solution is planned or underway.
_____(5) advice was not applicable to particular problem but useful on others.
_____(6) problem solved without utilization of advice/assistance.

5. If implementation of advice/assistance has been accomplished or is planned, estimate the savings. (answer as many as are appropriate)

(1) Savings in one time repair or construction cost. $_____
(2) Savings in maintenance cost. $_____per _____(time period)
(3) Savings in operating cost. $_____ per _____(time period)
(4) Other. Explain: _____

_____

Figure 16 FESO Project Effectiveness Questionnaire

Page 1 of 2

6. Do you feel the solution to the problem could be applicable to other activities? (check one)

_____ (1) Yes _____ (2) No

7. Many improvement projects have intangible benefits that are independent of measurable dollar benefits. If CEL/RDT&E advice and/or assistance was utilized, then estimate the intangible effects. (check as many as are appropriate)

_____(1) The technology was used on more than one project.
_____(2) The advice and/or assistance provided stimulus for subsequent solutions to other projects.
_____(3) Reduced the subsequent severity of the problem.
_____(4) Increased safety factor.
_____(5) Increased morale.
_____(6) Increased education/training of personnel.
_____(7) Dollar savings were only benefit derived.
_____(8) Other intangible benefits: _____

_____

8. Where did you learn of the availability of Civil Engineering Lab's FESO Program for assistance on field problems?

_____

Name of person originating request: _____

Activity _____ Position _____ Autovon No. _____

Name of person filling out questionnaire (if different than originator):

_____

Activity _____ Position _____ Autovon No. _____

Project number: _____

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53

Figure 16 FESO Project Effectiveness Questionnaire

Page 2 of 2

CEL ASSISTANCE FEEDBACK QUESTIONNAIRE

1. Description of request: _____

_____

_____

2. Do you consider the advice/assistance given was in any way beneficial? (If CEL contact led to another source of useful information, check Yes and consider that information in answering questions 4 through 8.)

____(1) Yes ____(2) No

3. If not, why not? (Upon completion of this question, skip questions 4 through 8) (check one)

____(1) no reply received.
____(2) no advice/assistance available from CEL.
____(3) advice/assistance given was incomplete/insufficient.
____(4) advice/assistance given didn't apply to problem/project.
____(5) didn't agree with advice/assistance given.
____(6) advice/assistance received too late.
____(7) solution/recommendation too expensive.
____(8) other. Please explain: _____

_____

4. Describe the use of the advice/assistance provided. (check one)

____(1) directly implemented.
____(2) direct implementation planned as part of: (pick one)
____(21) funded project in FY ____
____(22) budgeted project in FY ____
____(23) planned project in FY ____
____(3) implementation being considered. (pick one)
____(31) test and evaluation is underway or planned.
____(32) more extensive research on proposed solution is underway or planned.
____(4) general information for future use
____(5) other. Please explain: _____

_____

_____

Figure 17 CEL Assistance Feedback Questionnaire

Page 1 of 2

5. If implementation of advice/assistance has been accomplished, is planned, or is being considered, estimate the savings. (answer as many as are appropriate)

(1) savings in one time construction or repair cost. $ _____

(2) savings in maintenance cost. $ _____ per _____ (time period)

(3) savings in operating cost. $ _____ per _____ (time period)

(4) If savings are not estimable in dollars, but were intangible (reduced the severity of the problem, increased efficiency, increased safety, increased morale and/or living conditions, etc.) what was the dollar value of the project, or portion of the project, to which the advice/assistance applied? $ _____

(5) other. Please explain: _____

_____

6. Describe the contribution of the advice/assistance to the overall decision. (check one)

____(1) confirmed an earlier opinion/conclusion.

____(2) helped select between previously known alternative approaches/solutions.

____(3) provided information used in developing a better alternative approach/solution than was previously planned.

____(4) provided a recommendation which was a completely new (not previously known locally) and better alternative.

7. Of the total information used to make the decision which resulted in the above savings, what portion/percentage was provided by CEL? (check one)

___10 ___20 ___30 ___40 ___50 ___60 ___70 ___80 ___90 ___100

8. Do you feel the approach/solution to the problem/project could be applicable to other Shore Activities?

___(1) Yes ___(2) No

Name of person who originated request: _____

Activity: _____ Autovon No. _____

Name of person filling in questionnaire (if different than originator)

_____

Activity: _____ Autovon: _____

Assistance number: _____

Figure 17 CEL Assistance Feedback Questionnaire

effectiveness of the Assistance Program. A review of the basic approach is included along with modifications by this author to provide continuity.

The basic approach taken was to identify distinguishable categories into which requests could be grouped. In so grouping, consideration was given to assuring that the methods of quantifying benefits within each group was workable within the time resources of both the evaluator and the persons surveyed. Also, the number of groups was limited to a meaningful number relative to the size of the survey group. Thus, if the requestor indicated that the information which he had received was in any way beneficial, the request would then be categorized into the group which best suited the request at hand. The groups ranged from easily identified benefits, through more subjective quantification methods to a final unquantifiable category.

C. CATEGORIZATION OF REQUESTS

Hendrickson and Fisher developed a three-way categorization of each beneficial request. The essence of the categorization process, after determination of whether or not a benefit existed, reduced to the testing of each request with three questions:

1. (First Categorization) Did the information provided take the form of a specific recommendation for solution of a problem, or did it merely provide information which was combined with information from other sources to form a basis on which a decision for action (or in some cases, no action) could be based?

2. (Second Categorization) What was the probability that the information provided will be acted upon? That is, has

the information been implemented, or is implementation planned, or is implementation dependent on results of tests, or is the information being evaluated to determine the advisability of implementation?

3. (Third Categorization) Is the realized or expected benefit, if implemented, estimable in terms such as reduced cost or eliminated cost?

This three-way categorization resulted in seventeen different groups or "benefit codes" into which a given beneficial request might be categorized. The complete breakdown of the groups into which a request could fall based on this three-way categorization are shown in Figure 18.

In addition, standard methods of quantifying the present value of expected future benefits for each request were derived, and an ordinal ranking of the subjectivity of the benefit codes was achieved.

The following subsections describe how the various subjective factors were determined to be appropriate for each phase of the three-way categorization process. Although Hendrickson and Fisher developed mean values and ranges of accuracy, only the mean values are discussed and used in this study, since it is intended as a basis for operational use.

1. First Categorization, Action Recommended, Versus Information Provided

Hendrickson and Fisher originally conceived that CEL would be given 100 percent credit for benefits which resulted from a specific action recommendation. Benefits credited to CEL for providing partial information on a problem were to be reduced by an appropriate factor representing the relative value of the information. This factor was expressed as a

CATEGORIZATION OF FY-74 ASSISTANCE REQUESTS

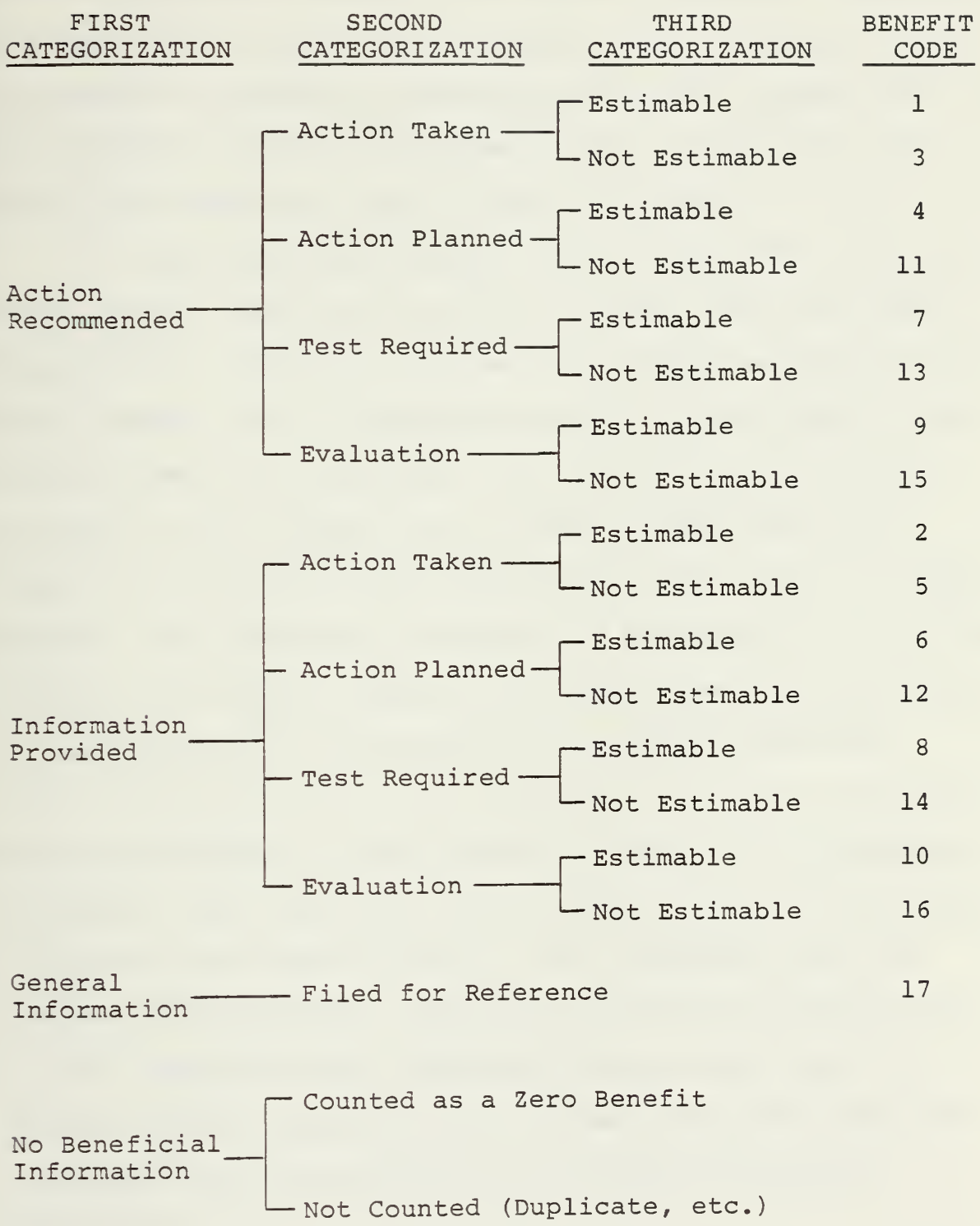

Figure 18 Categorization of FY-74 Assistance Requests

percentage of the total information required to perform the action necessary to realize the benefit in question. However, the approach of giving CEL 100 percent credit for all "Action Recommended" requests was abandoned when they realized that on many requests much of the recommendation incorporated procedures which were well known at the field level.

They correctly realized that to credit CEL with the total benefit resulting from such a request would be clearly inappropriate. Thus an "information-%-factor" was applied to every request. The information-%-factor was assigned to each case by them on an individual basis. The total information available on the request was reviewed by Hendrickson and Fisher, who had first-hand experience in Shore Facilities Management. The factor was selected from the range of .01 to 1.00 based on the relative effects the CEL-provided information had on the selection of the beneficial alternative available. Other considerations were the availability of the information from other sources and the relative benefit of the next best alternative that would have been selected had the CEL-provided information not been available. They recognized that the accuracy of subjectively assigning a relative percentage was less for requests where information was provided then for requests where a specific action recommendation was made, but maintained this categorization for purposes of ranking subjectivity.

Since ranking subjectivity would serve no useful purpose in an on-going system, and an information-%-factor was to

be applied to every beneficial request, there was no need for the first categorization in the modified model. Therefore, it was deleted.

It was decided to gather data on the value of the information provided by CEL direct from the user. In this way, the subjectivity of the procedure would be decreased. This data was obtained via questions 6 and 7 on the revised questionnaire (Figure 17). Since question 7 required a numeric answer, these answers were used in calculating individual benefit. It was considered that at some later date sufficient data would be available to determine the correlation between the answers to questions 6 and 7 and thereby develop some reliable factors to apply to the answers to question 6. This would allow the potential obstacle of missing data to be overcome should some respondent recognize the similarity of the two questions and elect to answer only question, but not question 7.

Elimination of the first categorization simplified the evaluation model considerably in that half of the first sixteen benefit codes were deleted. This resulted in an initial structure containing nine benefit codes, including the "General Information" benefit code.

2. Second Categorization, Probability of Implementation

Requests for which the response had been considered beneficial were classified by Hendrickson and Fisher into one of the following categories which were adopted "as is" for use in this study and are listed in descending order according to

the probability that the information provided would be implemented:

1. Information had been implemented. (Action Taken)

2. Implementation is planned. (Action Planned)

3. Testing is planned or underway; implementation is intended if tests are successful. (Test Required)

4. Information is being evaluated; implementation is intended provided evaluation indicates that expected benefits are probable; testing may be necessary. (Evaluation)

5. The information provided was of a general type; not related to a specific project. (General Information, Filed for Reference)

Based on their experience, Hendrickson and Fisher assigned probabilities to each of the middle three categories (2, 3, and 4 above) and that factor was applied to the benefit which would be expected if the project were implemented. The first category required no factor (or a factor of 1.0) since implementation had already been accomplished. The fifth category was left unquantified.

The probability value for the middle three implementation factors: Planning factor, Testing factor, and Evaluation factor, were selected and applied to all requests as appropriate. The mean values they agreed on for the probability of these implementation factors were as follows:

FACTOR	PROBABILITY
Planning	0.5
Testing	0.3
Evaluation	0.2

A review of these mean probability values in the light of the experience of the author resulted in no reason to use

other values, except in the case of the Planning factor. There are several identifiable phases in the planning cycle which should reasonably be expected to affect the ultimate fate of a project in terms of whether it is realized or not. These phases are:

1. Funded projects for which funds have been earmarked, although the project has not yet been implemented.

2. Budgeted projects which are included in the budget requests sent forward to higher authority although not yet acted upon.

3. Planned projects which are recognized as requirements, but whose importance is not such that they are included in current budget requests.

The probability of implementation is different for projects in each of these phases. There appeared to be little difference between a Funded project that is implemented and one that isn't, in terms of whether or not a decision will be made to use a particular piece of information. The timing of the decision is the variable, rather than the probability that the project will be funded. Accordingly, a planning factor of 1.00 was used for those projects that were funded, but not yet implemented.

At the other end of the scale, no plausible reason could be found for using an implementation factor other than 0.50 for Planned projects.

For Budgeted projects, there is a greater probability that they will be funded compared to Planned projects, and a lesser probability that they will be funded compared to Funded projects. Thus the probability of being funded is between that of Funded and Planned projects. Until experience with

the system indicates that the use of another factor would be more appropriate, a factor of 0.75, i.e., midway between the other factors, was arbitrarily selected for use.

This breakdown of the Action Planned category into three phases resulted in again expanding the number of benefit codes. Figure 19 shows the complete breakdown of the benefit codes into which a request could be categorized.

3. Third Categorization, Quality of Dollar Estimation

a. Estimable Requests

Requests with dollar savings specifically identified on the FESO Project Effectiveness Questionnaire (Figure 16, Question 5) were classified by Hendrickson and Fisher as estimable. If the identified savings were of the one-time type, versus recurring, the amount so identified was used as the request benefit. The benefit credited to CEL assistance for such a request was the request benefit reduced by the factor for implementation probability and the information-%-factor as appropriate. If the estimable identified savings were of the recurring type, the request benefit used was the present value of the first five years of savings. A present value factor of 3.935 was used for a steady cash flow throughout the year, utilizing a 10 percent rate of return. A present value factor of 3.977 was used for this study to conform with current NAVFAC guidelines [Ref. 14]. Again the benefit credited to CEL assistance was the request benefit reduced by appropriate factors as done above.

BENEFIT CODE CATEGORIES

BENEFIT
ESTIMABLE

Code	
01	Action Taken
02	Action Planned, Funded
03	Action Planned, Budgeted
04	Action Planned, Planned
05	Action Considered, T and E Required
06	Action Considered, More Research Required

BENEFIT NOT
ESTIMABLE

Code	
07	Action Taken
08	Action Planned, Funded
09	Action Planned, Budgeted
10	Action Planned, Planned
11	Action Considered, T and E Required
12	Action Considered, More Research Required
13	General Information
14	No Benefit
15	Duplicate Request

Figure 19. Benefit Code Categories

b. Not-Estimable Requests

Beneficial requests which did not have specifically identified dollar savings generally fell into areas where the benefit was in the form of improved operations, better morale, increased safety, etc. In the FY-72 and FY-73 surveys, benefits of requests of this type were left unquantified. The approach taken by Hendrickson and Fisher was that with the exception of requests which fell into the General Information category, each request had an identifiable benefit even though it was not readily quantifiable in terms of direct dollar savings. They felt that each could, in some way, be identified with a project, the magnitude of which was normally relatively easily quantified.

At this point, Hendrickson and Fisher made an assumption upon which a major portion of their analysis of the benefit of not-estimable requests was based. They assumed that, in order to commit funds to a project, a decision maker must, whether he realized it or not, expect a return in future benefits which is some percentage greater in present value than the initial outlay. They allowed that this percentage might vary from decision maker to decision maker, but further assumed that a reasonable value for this would be ten percent. This represented a minimum expectation. Many projects whose expected return exceeded this minimum would be undertaken, and, of course, the actual benefit of a project might fall short of the expectation and yield substantially less than ten percent. Nevertheless, a mean value of ten percent seemed

intuitively appropriate and consistent with rate of return guidelines for cost benefit analysis procedures. No fault could be found in this logic, and even though it appeared to be somewhat conservative, there was no logical basis for selecting another value. Accordingly it was used in this study.

APPENDIX E

MODIFICATION OF INITIAL DATA GATHERING INSTRUMENT

In 1971, procedures were formalized to monitor the flow of information between the field users and the laboratory as a means of developing information to measure the usage of the service by field units. A form was developed to gather information on assistance requests that were received and answered by telephone (Figure 20). Since the bulk of the requests are initially received by telephone, and many are answered by the same method, a method was needed to allow convenient documentation and follow-up on their progress. To avoid placing an inordinate and unnecessary burden on research and secretarial personnel, that would have resulted if formal memorandum reporting had required, the form was designed to allow completion by the researcher in his own handwriting and was printed on carbonless paper so he could retain a record for his own purposes. This instrument provided a convenient method to record and track those requests which did not result in some form of written communications with the requestor, and satisfied the information requirements of the researcher and the FESO alike. For example, the data on these forms was used as input to produce the performance measures previously discussed and shown in Appendix A. However, efforts to evaluate benefit would require obtaining certain additional information. It was considered that some of this information could best be gathered by CEL researchers during the initial call

RECORD OF RESPONSE TO VERBAL REQUEST FOR RDT&E ASSISTANCE _____
NCEL (T) 3960/38 (7-71)
date

INSTRUCTIONS FOR RECORD OF RESPONDING TO VERBAL REQUESTS FOR RDT&E ASSISTANCE FORM

1. This form is for recording verbal requests for RDT&E Assistance that do not result in an official letter being sent to the requestor.
2. Fill in by hand using ballpoint pen, or type if you prefer.
3. If request is satisfied during the initial conversation with the requestor, complete items 1 thru 6, send original to L03C and make appropriate internal distribution.
4. If further action is required after initial contact, complete items 1 thru 5 and send copy to L03C. Whoever is assigned action, complete item 6, send original to L03C and make appropriate internal distribution.
5. Comments or suggestions to improve the form should be directed to L03C.

---

1. Received by: _____ _____ _____
   name code extension
2. How received: (check one) telephone____ NCEL visit____ site visit_____
3. From: _____ _____
   name telephone
   _____ _____ _____
   title code activity
4. Details of request: _____

   _____

   _____

   _____
5. Was request satisfied during initial contact? Yes _____ No_____
   a. If no, who will complete? _____ name
   b. If no, estimated manhours to complete: 0-8_____ 8-20_____ over 20_____
6. Nature of service performed or information supplied (include dates): _____

   _____

   _____

   _____

   _____

   _____

   _____

   _____ _____
   DATE

Copy to: _____, _____, L03C
division other

Figure 20 Record of Response to Verbal Request for RDT&E Assistance

for assistance. Accordingly, the form was revised and is shown in Figure 21. With the exception of format changes to increase the amount of space available for writing, only three questions were added.

Question Number 5 was added to obtain information that would relate the request to a particular type of field project. This information would be used to calculate benefits, since construction or repair projects would result in one-time benefits, while maintenance and operating improvements would generate annual benefits that would have to be discounted to present values.

Question Number 8 was included to obtain a better assessment of the approximate cost of responding to requests that were initiated by telephone. Accordingly the researcher was asked to indicate the approximate number of hours expended on a particular request. This information was not used in this study, but provides input to a data base for future cost/benefit studies at a minimal collection cost.

Question Number 9 requests the researcher to make a purely subjective estimate concerning the possible value of the assistance provided to the requestor. Since the form was not revised until December 1976, this type of information was not available from CEL researchers for this study. However, it will be available for future evaluations to guide the FESO in excluding specific requests from further evaluation on the basis that they do not contain measurable benefit.

RECORD OF RESPONSE TO VERBAL REQUEST FOR FIELD ASSISTANCE

Date Received

CEL (T) 3960/38 (12-76) Rev.

1. Use form to record verbal requests that do not result in a letter reply to the requestor.
2. Use ballpoint pen, or typewriter.
3. If request is satisfied during the initial conversation, complete items 1 thru 9, send orig. to L03C and make appropriate internal distribution.
4. If further action is required after initial contact, complete items 1 thru 6 and send copy to L03C. Whoever is assigned action, complete items 7 thru 9, send original to L03C and make appropriate internal distribution.

1. Received by: _____ (Name) _____ (Code) _____ (Extention)

2. How Received (check one)
   - ☐ Telephone
   - ☐ CEL visit
   - ☐ Site visit

3. From: _____ (Name) _____ (Code) _____ (Telephone)

_____ (Title) _____ (Activity)

4. Details of request: _____

5. Type of project: (check one) ☐ Construction ☐ Repair ☐ Maintenance ☐ Operation ☐ General Info. ☐ Other _____

6. Was request satisfied during initial contact? ☐ Yes ☐ No (answer questions below)

   a. Who will complete? _____ (Name) b. Est. manhours to complete: (check one) ☐ 0-8 ☐ 8-20 ☐ Over 20

7. Nature of service provided (include dates): _____

8. Manhours charged (circle no.): 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

9. To help decide whether L03C should obtain cost/benefit information from the requestor, please indicate your best estimate of the potential cost savings.

   ☐ Less than $500 ☐ $500 - $5,000 ☐ $5,000 - $25,000 ☐ Over $25,000

Copy to: L03C, _____ (Division), Other: _____, _____, _____, _____ Date Completed _____

Figure 21 Record of Response to Verbal Request for Field Assistance

APPENDIX F

TYPICAL SAMPLING CALCULATIONS

Mean: The sample group mean of the value X is given by

$$\overline{X} = \frac{1}{n} \sum_{i=1}^{n} X_i$$

where X_i = benefit of individual request

n = number of requests in sample group

Standard Deviation: The sample standard deviation is given by

$$\hat{S} = \sqrt{\frac{\sum X_i^2 - \frac{\sum (X_i)^2}{n}}{n - 1}}$$

where $n - 1$ = degrees of freedom

Confidence Limits: When small random samples (n 30) of size n are taken from a normally distributed population, the statistic "t" has the Student's distribution with $n - 1$ degrees of freedom. The 95% confidence limits for "t" are given by

$$t_{95} = \overline{X} \pm t_{.975} \frac{\hat{S}}{n}$$

where $t_{.975}$ is the confidence coefficient for which 2.5% of the area lies in each tail of the "t" distribution.

Multiple Group Sampling - Group No. 1: 4 requests

X_i
1,150
0
8,380
0
$\sum$ = 9,530

$$\overline{X} = \frac{9,530}{4} = 2,382.5$$

Sampling Trial No. 1: 3 groups of 4 requests each

Group No.	X_i	$\overline{X}$	$(\overline{X}_i)^2$
1		2,382.5	5,676,306
	17,500		
	15,000		
	23,862		
	30,000		
2		21,590.5	466,149,690
	9,943		
	0		
	0		
	39,770		
3		12,428	154,455,184
	$\sum$ =	36,401	626,281,180

$$\overline{X} = \frac{36,401}{3} = 12,134$$

Sampling Trial No. 1 (Continued)

$$\hat{S} = \sqrt{\frac{626,281,180 - \frac{(36,401)^2}{3}}{2}} = 9,607$$

$$t_{95} = X \pm t_{.975} \frac{\hat{S}}{n - 1}$$

$$= 12,134 \pm 4.303 \times \frac{9,607}{3}$$

$$t_{95} = 12,134 \pm 23,868$$

Limits of 95% Confidence Interval (Table III)

Mean Benefit:

Lower Limit = 12,134 - 23,868 = -11,734

Upper Limit = 12,134 + 23,868 = 36,002

Total Benefit:

Lower Limit = -11,734 x 115 = -1,349,410

Upper Limit = 36,002 x 115 = 4,140,230

ROI for investment of $53,766

$$\text{Lower Limit} = \frac{-1,349,410}{53,766} = -25$$

$$\text{Upper Limit} = \frac{4,140,230}{53,766} = 77$$

Grouped Sequential Sampling - Trial No. 8: 18 requests

Group No.	X_i	$(X_i)^2$
1	1,150	1,322,250
	0	0
	8,380	70,224,400
	0	0
2	17,500	306,250,000
	15,000	225,000,000
	23,862	569,395,044
	30,000	900,000,000
3	9,943	98,863,249
	0	0
	0	0
	39,770	1,581,652,900
4	0	0
	8,380*	0
	0	0
	239	57,121
5	0	0
	0	0
	0	0
	15,000*	0
$\sum$ =	145,844	3,752,764,964

*repeated request

$$\overline{X} = \frac{145,844}{18} = 8,102$$

$$\hat{S} = \sqrt{\frac{3,752,764,964 - \frac{(145,844)^2}{18}}{17}}$$

$$t_{95} = 8,102 \pm \frac{2.110\ (12,298)}{18} = 8,102 \pm 6,116$$ Table IV Page 4 of 4

APPENDIX G

ASSISTANCE PROGRAM BENEFIT
REPORT SPECIFICATIONS

LIST OF FIGURES

22 Report Specification - Original Estimate of Total Benefit - Report #12

23 Report Specification - Breakdown of Evaluation Status - Report #13

24 Report Specification - Breakdown of Field Evaluation Data - Report #14

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29 Report Specification - Statistics for Evaluated Benefits - Report #18A

30 Report Specification - Summary of Benefits by Benefit Codes - Report #19

31 Report Specification - Estimated Minimum Remaining Benefit by Benefit Estimate - Report #20

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ASSISTANCE PROGRAM BENEFIT
REPORT SPECIFICATIONS

REPORT TITLE: Original Estimate of Total Benefit

REPORT NUMBER: 12

PURPOSE: This report provides an original estimate of total benefit from all requests received from shore activities during the reporting period. It is based on the estimated ranges of potential benefit of each request without prior knowledge of field evaluations. It will be used to roughly estimate total benefit before field evaluations are started.

INPUT PARAMETERS FROM EACH REQUEST: Estimates of Benefit.

SELECTION CONSTRAINTS:

1. Include all requests from shore activities.
2. Include all requests for selected quarter.

DATA MANIPULATION REQUIREMENTS:

1. Sum and print the number of requests in each range:
   a. Zero dollars
   b. From 1 to 499 dollars
   c. From 500 to 4,999 dollars
   d. From 5,000 to 24,999 dollars
   e. Over 25,000 dollars
2. Calculate and print estimated benefit in each range. Multiply number of requests in each range by mid-value of respective range. Use 25,000 for "over 25,000 dollar" range.
3. Sum the estimated benefit in each range.

Figure 22. Report Specifications - Original Estimate of Total Benefit

OUTPUT PARAMETERS:

1. Number of requests in each range
2. Estimated benefit in each range
3. Total estimated benefit

FREQUENCY: Quarterly

Figure 22

Page 2 of 2

ASSISTANCE PROGRAM BENEFIT
REPORT SPECIFICATIONS

REPORT TITLE: Breakdown of Evaluation Status

REPORT NUMBER: 13

PURPOSE: This report summarizes the number of requests received from shore activities by whether and by whom an evaluation has been performed, by the estimated range of potential benefit. It is used to show the status of evaluation efforts for the reporting period.

INPUT PARAMETERS FROM EACH REQUEST: Evaluation, Estimate of Benefit

SELECTION CONSTRAINTS:

1. Include all requests from shore activities.
2. Include all requests for selected quarter.

DATA MANIPULATION REQUIREMENTS:

1. Identify and sum the number of requests in each evaluation phase.
2. Identify and sum the number of requests in each range of estimated potential value.
3. Provide a matrix of Estimate of Benefit and Evaluation.

OUTPUT PARAMETERS: Number of requests in each of the above categories.

FREQUENCY: Quarterly

Figure 23. Report Specifications - Breakdown of Evaluation Status - Report #13

ASSISTANCE PROGRAM BENEFIT
REPORT SPECIFICATIONS

REPORT TITLE: Breakdown of Field Evaluation Data

REPORT NUMBER: 14

PURPOSE: To determine the number and type of responses to the feedback questionnaire used to evaluate requests from shore activities. This report provides background information for directing future program efforts and effectiveness measurements.

INPUT PARAMETERS FROM EACH REQUEST: Estimate of Benefit, Any Benefit, No Benefit, Benefit Code, Use of Advice or Assistance, Type of Saving, Contribution of Advice or Assistance to Decision, Percent of Information Provided by CEL Compared to Total, Would Solution be Applicable to Other Activities.

SELECTION CONSTRAINTS:

1. Include all shore activity requests
2. Include all requests for selected quarter
3. Include all requests which have been evaluated in the field.

DATA MANIPULATION REQUIREMENTS:

1. Identify and sum responses for the above parameters.
2. Determine frequencies for identified responses.

OUTPUT PARAMETERS: Number of requests in each of above categories.

FREQUENCY: Quarterly

Figure 24. Report Specification - Breakdown of Field Evaluation Data - Report #14

ASSISTANCE PROGRAM BENEFIT
REPORT SPECIFICATIONS

REPORT TITLE: Comparison of Contribution and Information Provided

REPORT NUMBER: 15

PURPOSE: This report summarizes the field evaluation data provided in response to questions on requests received from shore activities related to the contribution of CEL assistance and the percentage it represented compared to the total required to make the decision. It will be used to determine the correlation between the two parameters in a later attempt to establish reliable factors for each of the Contribution categories;

INPUT PARAMETERS FROM EACH REQUEST: Contribution of Advice or Assistance to Decision, Percentage of Information Provided by CEL Compared to Total.

SELECTION CONSTRAINTS:

1. Include all requests from shore activities.
2. Include all requests for selected quarter.
3. Include all requests which have been evaluated in the field.

DATA MANIPULATION REQUIREMENTS:

1. Identify and sum the number of requests in each Contribution category.
2. Identify and sum the number of requests in each Percentage category.
3. Provide a matrix of Contribution and Information Provided.

Figure 25. Report Specifications - Comparison of Contribution and Information Provided - Report #15

OUTPUT PARAMETERS: Number of requests in each of the above categories.

FREQUENCY: Quarterly.

Figure 25.

Page 2 of 2

ASSISTANCE PROGRAM BENEFIT
REPORT SPECIFICATIONS

REPORT TITLE: Summary of Savings by Type of Savings

REPORT NUMBER: 16

PURPOSE: This report provides the savings for requests from shore activities during the reporting period which have been evaluated in the field, by the type of saving. This information will be used to indicate how savings from assistance pro-requests are distributed among the various types of savings.

INPUT PARAMETERS FROM EACH REQUEST: Type of Savings, One-Time Construction or Repair Cost Saving, Annual Maintenance Cost Saving, Annual Operating Cost Saving, Project Cost.

SELECTION CONSTRAINTS:

1. Include all shore activity requests.
2. Include all requests for selected quarter.
3. Include all requests which have been evaluated in the field.

DATA MANIPULATION REQUIREMENTS:

1. Identify and sum the savings in each type of savings.
2. Identify and sum project costs.
3. Calculate the mean saving for each type of saving.
4. Calculate the mean project cost.

OUTPUT PARAMETERS:

1. Number of requests in each category.
2. Total savings for each type of savings.
3. Total project cost.
4. Mean savings for each type of savings.
5. Mean project cost.

FREQUENCY: Quarterly

Figure 26. Report Specifications - Summary of Savings by Type of Savings - Report #16

ASSISTANCE PROGRAM BENEFIT
REPORT SPECIFICATIONS

REPORT TITLE: Estimated Minimum Benefit of Evaluated Requests

REPORT NUMBER: 17

PURPOSE: This report provides an estimate of minimum total benefit for requests from shore activities during the reporting period, which have been evaluated in the field. It is based on the estimated range of potential benefit for each evaluated request. It will be used to determine the accuracy of estimating techniques and to determine the mid-level value for requests with benefits over $25,000.

INPUT PARAMETERS FROM EACH REQUEST: Estimate of Benefit.

SELECTION CONSTRAINTS:

1. Include all requests from shore activities.
2. Include all requests for selected quarter.
3. Include all requests which have been evaluated in field.

DATA MANIPULATION REQUIREMENTS:

1. Sum the number of requests in each range of estimated potential benefit.
2. Calculate and print estimated benefit in each range. Multiply number of requests in each range by mid-value of respective range. Use 25,000 dollars for "over 25,000 dollar" range.
3. Sum the estimated benefit in each range.

Figure 27. Report Specifications - Estimated Minimum Benefit of Evaluated Requests - Report #17

OUTPUT PARAMETERS: Number of requests in each range.

1. Number of requests in each range.
2. Estimated benefit in each range.
3. Total estimated benefit.

FREQUENCY: Quarterly.

Figure 27

Page 2 of 2

ASSISTANCE PROGRAM BENEFIT
REPORT SPECIFICATIONS

REPORT TITLE: Summary of Evaluated Benefit by Type of Savings

REPORT NUMBER: 18

PURPOSE: This report provides the benefit of requests from shore activities during the reporting period, which have been evaluated in the field, by the type of saving. It is based on the savings or project cost provided by the user. It will be used to indicate how assistance benefit is distributed among the various types of savings.

INPUT PARAMETERS FROM EACH REQUEST: Type of Saving.

SELECTION CONSTRAINTS:

1. Include all shore activity requests.
2. Include all requests for selected quarter.
3. Include all requests which have been evaluated in the field.

DATA MANIPULATION REQUIREMENTS:

1. Calculate and print benefit for each benefit code and corresponding type of saving.
2. Sum the benefit for each type of saving.
3. Calculate mean benefit for each type of saving and total benefit.

OUTPUT PARAMETERS:

1. Number of requests for each type of saving.
2. Benefit for each type of saving.
3. Mean benefit for each type of saving.

Figure 28. Report Specification - Summary of Evaluated Benefits by Type of Savings - Report #18

4. Total Benefit.

5. Mean of total benefit.

FREQUENCY: Quarterly

Figure 28

Page 2 of 2

ASSISTANCE PROGRAM BENEFIT
REPORT SPECIFICATIONS

REPORT TITLE: Statistics for Evaluated Benefits

REPORT NUMBER: 18A

PURPOSE: This report provides statistical analyses of the benefits of requests from shore activities during the reporting period, which have been evaluated in the field, by the type of saving. It will be used to determine trends, if any, which exist between various reporting periods in the distribution of benefit among the various types of savings.

INPUT PARAMETERS FROM EACH REQUEST: Type of Saving

SELECTION CONSTRAINTS:

1. Include all shore activity requests.
2. Include all requests for selected quarter.
3. Include all requests which have been evaluated in the field.

DATA MANIPULATION REQUIREMENT: The SPSS procedures for range tests, which include the student "t" distribution, are used. Although these tests are not ideally suited for testing the significance between the sampled groups of benefits used in this study, they will at least provide an initial indication of the existence of any trends, when compared to the results of future evaluations.

OUTPUT PARAMETERS:

1. Analysis of variance.

Figure 29. Report Specification - Statistics for Evaluated Benefits - Report #18A

2. Significance of ranges and the differences between the mean benefit for each type of saving.

OUTPUT: Quarterly

Figure 29

Page 2 of 2

ASSISTANCE PROGRAM BENEFIT
REPORT SPECIFICATIONS

REPORT TITLE: Summary of Benefits by Benefit Code

REPORT NUMBER: 19

PURPOSE: This report provides the benefit of requests from shore activities during the reporting period, which have been evaluated in the field, by the type of benefit. It is based on the savings or project cost provided by the user. It will be used to indicate how benefit is distributed among the various types of benefit.

INPUT PARAMETERS FROM EACH REQUEST: Benefit Code.

SELECTION CONSTRAINTS:

1. Include all shore activity requests.
2. Include all requests for selected quarter.
3. Include all requests which have been evaluated in the field.

DATA MANIPULATION REQUIREMENTS:

1. Calculate and print benefit for each benefit code and corresponding type of savings.
2. Sum the benefit for each type of benefit.
3. Calculate mean benefit for each type of benefit and total benefit.

OUTPUT PARAMETERS:

1. Number of requests for each type of benefit.
2. Benefit for each type of benefit.
3. Mean benefit for each type of benefit.

Figure 30. Report Specifications - Summary of Benefits by Benefit Code - Report #19

ASSISTANCE PROGRAM BENEFIT
REPORT SPECIFICATIONS

REPORT TITLE: Estimated Minimum Remaining Benefit by Benefit Estimate

REPORT NUMBER: 20

PURPOSE: This report provides an estimate of the minimum benefit of requests from shore facilities during the reporting period which have not been evaluated in the office or the field. It is based on the estimated range of potential benefit for each un-evaluated request. It will be used to estimate remaining benefit, which when added to evaluated benefit will produce a more accurate value of total benefit after evaluations have started.

INPUT PARAMETERS FROM EACH REQUEST: Estimate of Benefit.

SELECTION CONSTRAINTS:

1. Include all shore activity requests.
2. Include all requests which have not been evaluated in office or field.
3. Include all requests for selected quarter.

DATA MANIPULATION REQUIREMENTS:

1. Sum the number of requests in each range of estimated benefit.
2. Calculate and print estimated benefit in each range. Multiply number of requests in each range by mid-value of respective range. Use 25,000 for "over 25,000 dollar" range.
3. Sum the estimated benefit in each range.

Figure 31. Report Specification - Estimated Minimum Remaining Benefit by Benefit Estimate - Report #20

OUTPUT PARAMETERS:

1. Number of requests in each range.
2. Estimated benefit in each range.
3. Total estimated benefit.

FREQUENCY: Quarterly

Figure 31
Page 2 of 2

ASSISTANCE PROGRAM BENEFIT
REPORT SPECIFICATIONS

REPORT TITLE: Comparison of Benefit Estimate and Benefit

REPORT NUMBER: 21

PURPOSE: This report summarizes the benefit of requests received from shore activities during the reporting period and estimated benefit of those requests. It will be used to determine the correlation between actual and estimated benefit within ranges of benefit.

INPUT PARAMETERS FROM EACH REQUEST: Estimate of Benefit.

SELECTION CONSTRAINTS:

1. Include all requests from shore activities.
2. Include all requests for selected quarter.
3. Include all requests which have been evaluated in the field.

DATA MANIPULATION REQUIREMENTS:

1. Calculate and print benefit for each benefit code and corresponding type of savings.
2. Recode benefits into range of estimated benefit.
3. Identify and sum the number of benefits in each range of estimated benefit.
4. Identify and sum the number of requests in each range of estimated benefit.
5. Provide a matrix of Benefit and Estimate of Benefit.

OUTPUT PARAMETERS: Number of requests in each of the ranges of estimated benefit.

FREQUENCY: Quarterly

Figure 32. Report Specification - Comparison of Benefit Estimate and Benefit - Report #21

```
RUN NAME          GENE EARLY
VARIABLE LIST     FY,QTR,PROGRAM,SERIAL,CNTRLNR,CARDNR,SUBCAT2,SUBCAT3,
                  SUBJCODE,YRIN,DAYIN,DATEIN,YROUT,DAYOUT,DATEOUT,ELAPSED,
                  MEDIUMIN,MEDIUMOT,JUDESIGN,REQUEST,STALOC,STASER,
                  STATION,PRIDIV,SECDIV,RESDIV,SUBJECT1,SUBJECT2,SUBJECT3,
                  REQSTA,EVAL,BNFTEST,ANYBNFT,NOBNFT,BNFTCOD,USE,USEFACTR,PV,
                  TYPSAV,ITMSAV,AMSAV,AOSAV,PRJCST,CONTRIB,INFO,OTHRUSE,BNFT
FILE NAME         ASSIST,ASSISTANCE PROGRAM DATA BASE
INPUT MEDIUM      CARD
COMMENT
COMMENT           BE CAREFUL - YOU MUST INSERT THE N OF CASES CARD NEXT
N OF CASES        188
COMMENT
INPUT FORMAT      FIXED (F2.0,F1.0,F1.0,F3.0,T4,F4.0,F2.0,F2.0,T10,F3.0,
                  T10,F4.0,F1.0,F3.0,T14,F4.0,F1.0,F3.0,T16,F4.0,F4.0,
                  F1.0,F1.0,F1.0,F3.0,F4.0,F3.0,T32,F7.0,F2.0,F2.0,
                  T39,F4.0,A8,A8,A8,T29,F10.0/T12,F1.0,F1.0,F1.0,F1.0,F2.0,F2.0,
                  F4.2,F5.3,F1.0,F6.0,F6.0,F6.0,F7.0,F1.0,F3.1,F1.0,F6.0)
VAR LABELS        FY,FISCAL YEAR/
                  QTR,QUARTER/
                  PROGRAM,PROGRAM FUNDING CODE/
                  SERIAL,SERIAL NR/
                  CNTRLNR,CONTROL NR/
                  CARDNR,CARD NR/
                  SUBCAT2,MAJOR SUBJECT CATEGORY/
                  SUBCAT3,INTERMEDIATE SUBJECT CATEGORY/
                  SUBJCODE,SUBJECT CODE/
                  YRIN,CALENDAR YEAR IN/
                  DAYIN,JULIAN DAY IN/
                  DATEIN,JULIAN DATE IN/
                  YROUT,CALENDAR YEAR OUT/
                  DAYOUT,JULIAN DAY OUT/
                  DATEOUT,JULIAN DATE OUT/
                  ELAPSED,ELAPSED TIME - DAYS /
                  MEDIUMIN,MEDIUM IN/
```

Assistance Program Data Definition Cards

```
                MEDIUMOT,MEDIUM OUT/
                JODESIGN,J.O.DESIGNATOR/
                REQUEST,REQUESTOR/
                STALOC,STATION LOCATION/
                STASER,STATION SERIAL NR/
                STATION,STATION/
                PRIDIV,PRIMARY DIVISION/
                SECDIV,SECONDARY DIVISION/
                RESDIV,RESPONSIBLE DIVISION/
                SUBJECT1,SUBJECT DESCRIPTION 1/
                SUBJECT2,SUBJECT DESCRIPTION 2/
                SUBJECT3,SUBJECT DESCRIPTION 3/
                REQSTA,REQUESTOR AND SNDL/
              ●EVAL,EVALUATION/
              ●BNFTEST,ESTIMATE OF BENEFIT/
              ●ANYBNFT,ANY BENEFIT/
              ●NOBNFT,NO BENEFIT/
              ●BNFTCOD,BENEFIT CODE/
              ●USE,USE OF ADVICE OR ASSISTANCE/
              ●USEFACTR,USE FACTOR/
              ●PV,DISCOUNTED PRESENT VALUE FACTOR/
              ●TYPSAV, TYPE OF SAVING/
              ●ITMSAV,ONE TIME CONSTRUCTION OR REPAIR COST SAVING/
              ●AMSAV,ANNUAL MAINTENANCE COST SAVING/
              ●AOSAV,ANNUAL OPERATING COST SAVING/
              ●PRJCST,PROJECT COST/
              ●CONTRIB,CONTRIBUTION OF ADVICE OR ASSISTANCE TO DECISION/
              ●INFO,PERCENT OF INFORMATION PROVIDED BY CEL COMAPARED TO TOTAL/
              ●OTHRUSE,WOULD SOLUTION BE APPLICABLE TO OTHER ACTIVITIES/
              ●BNFT,BENEFIT
VALUE LABELS    FY (71)TRANSIT QTR (74)FY-74 (75)FY-75 (76)FY-76
                (77)FY-77 (78)FY-78 (79)FY-79/
                QTR (1)1ST QTR (2)2ND QTR (3)3RD QTR (4)4TH QTR/
                PROGRAM ( )NON ENERGY FUNDED (0)NON ENERGY FUNDED
                (1)ENERGY FUNDED/
```

Assistance Program Data Definition Cards

```
SUBCAT2 (10)BREAKWATERS
(11)BUILDING MATERIALS
(12)CATHODIC PROTECTION
(13)CORROSION
(14)ENERGY
(15)FIRE PROTECTION
(16)MECHANICAL EQUIPMENT
(17)MOORINGS
(18)PAINTS,COATGS,CHEM
(19)PAVEMENTS
(20)POLLUTION
(21)PHYSICAL SECURITY
(22)POLAR
(23)ROOFING
(24)STRUCTURAL
(25)UTILITIES
(26)WATERFRONT
(27)FLOORING
(28)SHIELDING
(99)OTHER/
SUBCAT3 (100)BREAKWATERS
(101)BRKWTRS-PERMANENT
(102)BRKWTRS-PORTABLE
(110)BUILDING MATERIALS
(111)BLDG MTLS-CONCRETE
(112)BLDG MTLS-MASONRY
(113)BLDG MTL-PLSTCS,RSNS
(114)BLDG MTLS-TIMBER
(115)BLDG MTLS-OTHER
(116)BLDG MTLS-ADHESIVES
(117)BLDG MTLS-CAULKING
(120)CATHODIC PROTECTION
(130)CORROSION
(140)ENERGY
(141)ENERGY-ALT SOURCES
```

(142)ENERGY-CONSERVATION
(143)ENERGY-LOSSES
(144)ENERGY-OTHER
(150)FIRE PROTECTION
(160)MECHANICAL EQUIPMENT
(170)MOORINGS
(171)MOORINGS-DEEP WATER
(172)MOORINGS-HARBOR
(180)PAINTS,COATS,CHEM.
(181)P,C,CH-CHEMICALS
(182)P,C,CH-COATINGS
(183)P,C,CH-PAINTS
(184)P,C,CH-WATERPROOFING
(189)P,C,CH-MISC
(190)PAVEMENTS
(191)PAVEMENTS-APRONS
(192)PAVEMENTS-PRKNG AREA
(193)PVMNTS-ROADS,STREETS
(194)PAVEMENTS-RUNWAYS
(195)PAVEMENTS-SIDEWALKS
(196)PAVEMENTS-TAXIWAYS
(197)PAVEMENTS-TEMPORARY
(198)PAVEMENTS-OTHER
(200)POLLUTION
(201)POLLUTION-AIR
(202)POLLUTION-NOISE
(203)POLLUT-SOLID WASTE
(204)POLLUTION-WATER
(205)POLLUTION-OTHER
(210)PHYSICAL SECURITY
(211)PHYS SEC-FENCING
(212)PHYS SEC-OTHER
(220)POLAR
(230)ROOFING
(240)STRUCTURAL

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(241)STRUCT-DESIGN,GEN
(242)STRUCT-EXPLOS EFFECT
(243)STRUCT-SEISMIC EFFCT
(244)STRUCTURAL-OTHER
(250)UTILITIES
(251)UTILITIES-AIR
(252)UTILITIES-ELECTRICAL
(253)UTILITIES-GAS
(254)UTILITIES-SEWAGE
(255)UTILITIES-STEAM
(256)UTILITIES-WATER
(257)UTILITIES-OTHER
(260)WATERFRONT
(261)WATERFRONT-CAMELS
(262)WATERFRONT-FENDERS
(263)WATERFRONT-PILES
(264)WATERFRONT-PONTOONS
(265)WATERFRONT-OTHER
(270)FLOORING
(280)SHIELDING
(990)OTHER/
SUBJCODE (1000)BREAKWATERS
(1010)BRKWTRS-PERMANENT
(1020)BRKWTRS-PORTABLE
(1100)BUILDING MATERIALS
(1110)B.DG MTLS-CONCRETE
(1120)BLDG MTLS-MASONRY
(1130)BLDG MTLS-PLSTC,RSN
(1140)BLDG MTLS-TIMBER
(1150)BLDG MTLS-OTHER
(1160)BLDG MTLS-ADHESIVES
(1170)BLDG MTLS-CAULKING
(1200)CATHODIC PROTECTION
(1300)CORROSION
(1400)ENERGY
```

(1410)ENRGY-ALT SOURCES
(1411)ENRGY ALT SRC-GEOTH
(1412)ENRGY ALT SRC-SOLAR
(1413)ENRGY ALT SRC-WIND
(1414)ENRGY ALT SRC-OTHER
(1420)ENERGY-CONSERVATION
(1430)ENERGY-LOSSES
(1440)ENERGY-OTHER
(1500)FIRE PROTECTION
(1600)MECHANICAL EQUIP
(1700)MOORINGS
(1710)MOORINGS-DEEP WATER
(1720)MOORINGS-HARBOR
(1800)PAINTS,COATS,CHEM
(1810)P,C,CH-CHEMICALS
(1820)P,C,CH-COATINGS
(1830)P,C,CH-PAINTS
(1840)P,C,CH-WATERPROOF
(1900)PAVEMENTS
(1910)PAVEMENTS-APRONS
(1920)PAVEMENTS-PARK AREA
(1930)PVMNTS-ROADS,STREET
(1940)PAVEMENTS-RUNWAYS
(1950)PAVEMENTS-SIDEWALKS
(1960)PAVEMENTS-TAXIWAYS
(1970)PAVEMENTS-TEMPORARY
(1980)PAVEMENTS-OTHER
(2000)POLLUTION
(2010)POLLUTION-AIR
(2020)POLLUTION-NOISE
(2030)POLLUT-SOLID WASTE
(2031)POLUT,SLD WST-HANDL
(2032)SOLID WASTE-TRTMNT
(2033)SOLID WASTE CLASS D
(2040)POLLUTION-WATER

(2050)POLLUTION-OTHER
(2100)PHYSICAL SECURITY
(2110)PHYS SEC-FENCING
(2120)PHYS SEC-OTHER
(2200)POLAR
(2300)ROOFING
(2400)STRUCTURAL
(2410)STRUCT-DESIGN,GEN
(2420)STRUCT-EXPLOS EFFCT
(2430)STRUCT-SISMIC EFFCT
(2440)STRUCTURAL-OTHER
(2500)UTILITIES
(2510)UTILITIES-AIR
(2520)UTILITIES-ELECTRIC
(2521)UTILITY,ELECT-DISTR
(2522)UTILITY,ELECT-OTHER
(2530)UTILITIES-GAS
(2540)UTILITIES-SEWAGE
(2541)UTIL,SEWAGE-SHIPS
(2542)UTIL,SEWAGE-TREAT
(2543)UTIL,SEWAGE-OTHER
(2550)UTILITIES-STEAM
(2560)UTILITIES-WATER
(2561)UTIL,WATER-DISTR
(2562)UTIL,WATER-SUPPLY
(2563)UTIL,WATER-TREATMNT
(2564)UTIL,WATER-OTHER
(2570)UTILITIES-OTHER
(2600)WATERFRONT
(2610)WATERFRONT-CAMELS
(2620)WATERFRONT-FENDRS
(2630)WATERFRONT-PILES
(2640)WATERFRONT-PONTOONS
(2650)WATERFRONT-OTHER
(2700)FLOORING

```
(2800)SHIELDING
(9900)OTHER/
YRIN (4) CAL YR IN 74
(5)CAL YR IN 75
(6)CAL YR IN 76
(7)CAL YR IN 77
(8)CAL YR IN 78
(9)CAL YR IN 79/
YROUT (4)CAL YR OUT 74
(5)CAL YR OUT 75
(6)CAL YR OUT 76
(7)CAL YR OUT 77
(8)CAL YR OUT 78
(9)CAL YR OUT 79/
MEDIUMIN (1)LETTER
(2)MESSAGE
(3)TELEPHONE
(4)VISIT TO SITE
(5)VISITOR AT NCEL/
MEDIUMOT (1)LETTER
(2)MESSAGE
(3)TELEPHONE
(4)VISIT TO SITE
(5)VISITOR AT NCEL/
JODESIGN ( )SHORT TERM REQUEST
(1)JOB ORDER REQUEST/
REQUEST (10)CNM
(11)STAFF CE-SYSCOM
(12)STAFF CE-TYPE COMMAND
(20)NAVFAC
(21)NESO
(22)NAVNUCPWRUNIT
(30)EFD
(31)EFD-NORTHERN DIV
(311)EFD-NORTHERN DIV-NEW YORK BRANCH
```

(312)EFD-NORTHERN DIV-GREAT LAKES BRANCH
(32)EFD-CHESAPEAKE
(33)EFD-ATLANTIC
(331)EFD-ATLANTIC DIV-EUROPEAN BRANCH
(332)EFD-ATLANTIC DIV-PEURTO RICO BRANCH
(34)EFD-SOUTHERN
(341)EFD-SOUTHERN DIV-NEW ORLEANS BRANCH
(342)EFD-SOUTHERN DIV-NAVAL TRAINING BRANCH
(35)EFD-WESTERN
(351)EFD-WESTERN DIV-SEATTLE BRANCH
(352)EFD-WESTERN DIV-SAN DIEGO BRANCH
(36)EFD-PACIFIC
(40)PWC
(41)PWC-SAN FRANCISCO
(42)PWC-GREAT LAKES
(43)PWC-NORFOLK
(44)PWC-PENSACOLA
(45)PWC-SAN DIEGO
(46)PWC-PEARL HARBOR
(47)PWC-GUAM
(48)PWC-SUBIC
(49)PWC-YOKOSUKA
(50)STATIONS
(51)STATION-NORTHERN
(52)STATION-CHESAPEAKE
(53)STATION-ATLANTIC
(54)STATION-SOUTHERN
(55)STATION-WESTERN
(56)STATION-PACIFIC
(60)OICC AND ROICC
(61)OICC
(62)ROICC
(621)ROICC-NORTHERN
(622)ROICC-CHESAPEAKE
(623)ROICC-ATLANTIC

(624)ROICC-SOUTHERN
(625)ROICC-WESTERN
(626)ROICC-PACIFIC
(70)SEABEES
(71)CB LANT
(72)CB PAC
(73)CBC
(74)CESO
(75)MCB
(76)ACB
(77)UCT
(78)NCR
(79)CBU
(80)NON-NAVFAC
(90)NON-NAVY
(91)ARMY
(92)AIR FORCE/
STATION (1087400)COMNAVACTS UK
(1303500)NADC WARMINSTER
(1310943)NAF WASHINGTON
(1313050)NAF ATSUGI
(1392000)PMTC
(1405825)NAPTC TRENTON
(1450120)NAS BERMUDA
(1450202)NAS BRUNSWICK
(1450215)NAS CECIL FIELD
(1450436) NAS JACKSONVILLE
(1450484)NAS KEY WEST
(1451064)NAS ALAMEDA
(1451335)NAS FALLON
(1451546)NAS LEMOORE
(1451609)NAS MOFFET
(1451652)NAS WHIDBEY ISLAND
(1451800)NAS MIRAMAR
(1451808)NAS NORTH ISLAND

(1452292) NAS CORPUS CHRISTI
(1452570)NAS MEMPHIS
(1452580)NAS MERIDIAN
(1452590)NAS WHITING FIELD
(1452736)NAS PENSACOLA
(1453540) NAS LAKEHURST
(1453712)NAS PAX RIVER
(1453740)NAS PT MUGU
(1455364)NAS GLENVIEW
(1455550)NAS LOS ALAMITOS
(1455562)NAS ATLANTA
(1455616)NAS NEW ORLEANS
(1455860)NAS SOUTH WEYMOUTH
(1455976)NAS WILLOW GROVE
(1514440)NAD HAWTHORNE
(1514640) NAD MCALLISTER
(1536500)NAB LITTLE CREEK
(1746600)AVIATION SUPPLY OFFICE
(1790355)NAVAL AVIONICS FAC
(2130600) NCSL PANAMA CITY
(2476076)NCS DIEGO GARCIA
(2476085)NCS HAROLD E HOLT
(2476093)NCD BALBOA,CANAL ZONE
(2476300)NCAMS GUAM
(2476515)NCS GREECE
(2476625)NCS PUERTO RICO
(2476703)NCS SAN DIEGO
(2480130)NCU CUTLER
(2480750)NCU WASHINGTON
(2506400)NCBC GULFPORT
(2506600)NCBC PT HUENEME
(2547085)OICC THAILAND
(2547150)OICC TRIDENT
(2547420)OICC GUAM
(2560400)NCTC GULFPORT

(2560725)NCTC PORT HUENEME
(2831450)NETC NEWPORT
(2834600)NETPDC PENSACOLA
(3060090)NF CAPE HATTERAS
(3060775)NF GRAND TURK
(3061195)NF CENTERVILLE BEACH
(3070055)RUICC CHARLESTON
(3070745)RUICC PAC
(3427500)NAVAL HOME
(3515200)INACTIVE FLEET MAINT FAC BREMERTON
(3860930)NRL
(3860600) NAV BIOMED RES LAB
(4060475)NAVAL MAG LUALUALEI
(4170200) MED CENTER BETHSEDA
(4310390) PMTC
(4462350)NAV NUCLEAR POWER UNIT
(4470500)NAVAL OBSERVATORY
(4600120) NOS INDIAN HEAD
(4600130)NOS LOUISVILLE
(4670200) NPTR EL CENTRO
(5496285) NRMC CAMP PENDELTON
(5496475) NRMC NEWPORT
(5496800) NRMC SAN DIEGO
(5771325)NSGA EDZELL
(5771400)NSGA HOMESTEAD
(5771815)NSGA SKAGGS ISLAND
(5771910)NSGA WINTER HARBOR
(5775915)NAVSECSTA WASHINGTON
(5856900) NSRDC
(5867150)NSY PUGET SOUND
(5867190)NSY CHARLESTON
(5867250)NSY LONG BEACH
(5867600)NSY PEARL HARBOR
(5867625)NSY PHILADELPHIA
(5867650)NSY PORTSMOUTH

(5867051)NSY NORFOLK
(5867905)NSY MARE ISLAND
(6029284)NS GUANTANAMO
(6029480)NS MAYPORT
(6030012) NS ADAK
(6030500)NS MIDWAY
(6030690)NS SAN DIEGO
(6030695)NS TREASURE ISLAND
(6031675)NS ROTA
(6078600)NSB NEW LONDON
(6166900)NSC NORFOLK CHEATHAM ANNEX
(6170200) NSC BREMERTON
(6170650)NSC OAKLAND
(6170700) NSC PEARL
(6170750)NSC SAN DIEGO
(6175785)NSD SUBIC BAY
(6202135)NSA BROOKLYN
(6202450) NSA LONG BEACH
(6206900)NSF THURMONT
(6214950)NSWC WHITE OAK
(6214951)NSWC DAHLGREN LAB
(6303602)NIS NEYPORT
(6373700) NTC ORLANDO
(6380800)NTEC ORLANDO
(6430900) CNET PENSACOLA
(6480750)NOC SAN DIEGO
(6541500)NUSC NEWPORT
(6700200)NWC CHINA LAKE
(6805025)NWS CHARLESTON
(6805050)NWS CONCORD
(6805060)NWS EARLE
(6805700)NWS SEAL BEACH
(6805750)NWS YORKTOWN
(6810160)NWSC CRANE
(7010200)NAVAL ACADEMY

```
(7685435)NPGS
(8139060)MCAS BEAUFORT
(8139430)MCAS IWAKUNI
(8139700)MCAS KANEOHE BAY
(8139800)MCAS QUANTICO
(8139875)MCAS EL TORO
(8139950)MCAS YUMA
(8270175)MCB CAMP LEJEUNE
(8270551)MCB CAMP PENDLETON
(8270800)MCB TWENTYNINE PALMS
(8373200)MCSC BARSTOW
(8385650)MCDEC MARINE CORPS DEV AND EDUC COM-QUANTICO
(8600610)MCRD PARRIS ISLAND
(9909678) COMIBERLANT
(9913440) GRIFFITH AFB
(9943216)ROICC ROCKWELL COLUMBUS
(9984401)DEFENSE DEPOT OGDEN
(9996690) NAVSUPPFORANTARTICA/
PRIDIV (41)L41
(42)L42
(43)L43
(44)L44
(51)L51
(52)L52
(53)L53
(54)L54
(55)L55
(61)L61
(62)L62
(63)L63
(64)L64
(65)L65
(80)L80/
SECDIV (41)L41
(42)L42
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Assistance Program Data Definition Cards

```
(43)L43
(44)L44
(51)L51
(52)L52
(53)L53
(54)L54
(55)L55
(61)L61
(62)L62
(63)L63
(64)L64
(65)L65
(80)L80/
EVAL ( ) NONE (1) FIELD (2) OFFICE
BNFTEST (0) BLANK
(1) 0
(2) 1 TO 499
(3) 500 TO 4,999
(4) 5,000 TO 24,999
(5) OVER 25,000
(6) DUPLICATE/
ANYBNFT (1)YES (2)NO/
NOBNFT (1)NO INFO RECEIVED
(2)NO INFO AVAILABLE
(3)INFO WAS INCOMPLETE
(4)INFO NOT RELATED
(5)OIDN≠T  AGREE
(6)INFO TOO LATE
(7)TOO     EXPENSIVE
(8)OTHER/
BNFTCOD (01) ACTION TAKEN, ESTIMABLE
(02) ACTION PLANNED, FUNDED, ESTIMABLE
(03) ACTION PLANNED, BUDGETED, ESTIMABLE
(04) ACTION PLANNED, PLANNED, ESTIMABLE
```

```
                    (05) ACTION CONSIDERED, T AND E REQUIRED, ESTIMABLE
                    (06) ACTION CONSIDERED, MORE RESEARCH REQ'D, ESTIMABLE
                    (07) ACTION TAKEN, NOT ESTIMABLE
                    (08) ACTION PLANNED, FUNDED, NOT ESTIMABLE
                    (09) ACTION PLANNED, BUDGETED, NOT ESTIMABLE
                    (10) ACTION PLANNED, PLANNED, NOT ESTIMABLE
                    (11) ACTION CONSIDERED, T AND E REQ'D, NOT ESTIMABLE
                    (12) ACTION CONSIDERED, MORE RESEARCH REQ'D, NOT ESTIMABLE
                    (13) GENERAL INFO
                    (14) NO BENEFIT
                    (15) DUPLICATE/
                    USE (11)DIRECTLY IMPLEMENTED
                    (21)DIRECT IMPLEMENTATION PLANNED AS PART OF FUNDED PROJECT
                    (22)DIRECT IMPLEMENTATION PLANNED AS PART OF BUDGETED PROJECT
                    (23)DIRECT IMPLEMENTATION PLANNED AS PART OF PLANNED PROJECT
                    (31)IMPLEMENTATION CONSIDERED, T AND E UNDERWAY OR PLANNED
                    (32)IMPLEMENTATION CONSIDERED, MORE RESEARCH REQUIRED
                    (41)GENERAL INFORMATION FOR FUTURE USE
                    (51)OTHER/
                    TYPSAV  (1)SAVINGS IN ONE TIME CONSTRUCTION OR REPAIR COST
                    (2)SAVINGS IN ANNUAL MAINTENANCE COST
                    (3)SAVINGS  IN ANNUAL OPERATING COST
                    (4) NOT ESTIMABLE
                    (5) OTHER/
                    CONTRIB (1) CONFIRMED AN EARLIER OPINION OR CONCLUSION
                    (2) HELPED SELECT BTWN KNOWN ALTERNATIVE APPROACHES OR SOLUTIONS
                    (3) PROVIDED INFO USED FOR A BETTER ALTERNATIVE THAN PLANNED
                    (4) PROVIDED RECOMMENDATION FOR A BETTER SOLUTION/
                    OTHRUSE (1)YES (2)NO/
COMMENT               NEXT CARD IDENTIFIES ALPHANUMERIC VARIABLES
PRINT FORMATS         SUBJECT1,SUBJECT2,SUBJECT3 (A)
COMMENT
COMMENT               RECODE TO CORRECT ANY ERRONEOUS LEFT JUSTIFICATION OF INPUT DATA
COMMENT
RECODE                REQUEST (100=010)(110=011)(120=012)(200=020)(210=021)
                      (220=022)(300=030)(310=031)(320=032)
```

Assistance Program Data Definition Cards

```
                (330=033)(340=034)(350=035)(360=036)(400=040)(410=041)
                (420=042)(430=043)(440=044)(450=045)(460=046)(470=047)
                (480=048)(490=049)(500=050)(510=051)(520=052)(530=053)
                (540=054)(550=055)(560=056)(600=060)(610=061)(620=062)
                (700=070)(710=071)(720=072)(730=073)(740=074)(750=075)
                (760=076)(770=077)(780=078)(790=079)(800=080)(900=090)(910=091)
                (920=092)/
                PRIDIV (65=54)/SECDIV (65=54)
COMMENT
COMMENT         COMPUTATION OF REQUEST ELAPSED TIME
COMMENT
IF              (YROUT GT YRIN) ELAPSED=-635
IF              (YROUT EQ YRIN) ELAPSED= 0
COMPUTE         ELAPSED = ELAPSED + DATEOUT - DATEIN
COMMENT
COMMENT         ESTABLISH NEW VARIABLES
COMMENT
COMPUTE         RESPONSE=0
IF              (REQUEST GT 9 AND LT 70)GROUP=6
IF              (REQUEST GT 310 AND LT 353)GROUP=6
IF              (REQUEST GT 620 AND LT 627)GROUP=6
IF              (REQUEST GT 69 AND LT 80)GROUP=7
IF              (REQUEST EQ 80)GROUP=8
IF              (REQUEST GT 89 AND LT 93)GROUP=9
IF              (REQUEST GT 9 AND LT 13)USER=10
IF              (REQUEST GT 19 AND LT 23)USER=20
IF              (REQUEST GT 29 AND LT 37)USER=30
IF              (REQUEST GT 311 AND LT 353)USER=30
IF              (REQUEST GT 39 AND LT 50)USER=40
IF              (REQUEST GT 49 AND LT 57)USER=50
IF              (REQUEST GT 59 AND LT 62)USER=61
IF              (REQUEST GT 61 AND LT 63)USER=62
IF              (REQUEST GT 620 AND LT 627)USER=62
COMMENT
COMMENT         DESCRIBE NEW VARIABLES
```

```
COMMENT
VAR LABELS      GROUP,RDT AND E ASSISTANCE REQUEST GROUPS/
                USER,ASSISTANCE REQUESTORS BY INTERMED CAT/
                RESPONSE,REQUEST RESPONSE TIME
VALUE LABELS    GROUP (6)SHORE    FACILITY (7)SEABEES (8)NON NAVFAC
                (9)NON NAVY/
                USER(10)CNM

                USER(20)NAVFAC
                USER(30)EFDS
                USER(40)PWC
                USER(50)PWS
                USER(61)UICC
                USER(62)ROICC/
                RESPONSE (1)ZERO DAYS
                (2)1 TO 2 DAYS
                (7)3 TO 7 DAYS
                (14)8 TO 14 DAYS
                (30)15 TO 30 DAYS
                (31)OVER 30 DAYS
                (32)NOT ANSWERED
COMMENT
COMMENT
COMMENT         BE CAREFUL - YOU MUST INSERT ONE REPORT DECK NEXT
```

APPENDIX I

FESO AUTOMATED INFORMATION SYSTEM
TASK DEFINITION LOGIC FOR ASSISTANCE BENEFIT REPORTS

LIST OF FIGURES

33 Assistance Benefit Report #12 - Task Definition Logic

34 Assistance Benefit Report #13 - Task Definition Logic

35 Assistance Benefit Report #14 - Task Definition Logic

36 Assistance Benefit Report #15 - Task Definition Logic

37 Assistance Benefit Report #16 - Task Definition Logic

38 Assistance Benefit Report #17 - Task Definition Logic

39 Assistance Benefit Report #18 - Task Definition Logic

40 Assistance Benefit Report #18A- Task Definition Logic

41 Assistance Benefit Report #19 - Task Definition Logic

42 Assistance Benefit Report #20 - Task Definition Logic

43 Assistance Benefit Report #21 - Task Definition Logic

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COMMENT
COMMENT         $$$$
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COMMENT
COMMENT         $$$$
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COMMENT
COMMENT
COMMENT         $$$$
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COMMENT
COMMENT         $$$$
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COMMENT
COMMENT         $$$$
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COMMENT
COMMENT         $$$$
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COMMENT
COMMENT         $$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
COMMENT
COMMENT         BEGIN SUMMARY OF EVALUATED BENEFITS BY TYPE OF SAVINGS-REPORT 18
COMMENT
TASK NAME       SUMMARY OF EVALUATED BENEFITS BY TYPE OF SAVINGS - REPORT 18
*SELECT IF      (EVAL EQ 1)
*IF             (BNFTCOD EQ 01 AND TYPSAV EQ 1) BNFT=RND(ITMSAV*USEFACTR*INFO)
*IF             (BNFTCOD EQ 01 AND TYPSAV EQ 2) BNFT=RND(AMSAV*USEFACTR*INFO*PV)
*IF             (BNFTCOD EQ 01 AND TYPSAV EQ 3) BNFT=RND(AUSAV*USEFACTR*INFO*PV)
*IF             (BNFTCOD EQ 02 AND TYPSAV EQ 1) BNFT=RND(ITMSAV*USEFACTR*INFO)
*IF             (BNFTCOD EQ 02 AND TYPSAV EQ 2) BNFT=RND(AMSAV*USEFACTR*INFO*PV)
*IF             (BNFTCOD EQ 02 AND TYPSAV EQ 3) BNFT=RND(AUSAV*USEFACTR*INFO*PV)
*IF             (BNFTCOD EQ 03 AND TYPSAV EQ 1) BNFT=RND(ITMSAV*USEFACTR*INFO)
*IF             (BNFTCOD EQ 03 AND TYPSAV EQ 2) BNFT=RND(AMSAV*USEFACTR*INFO*PV)
*IF             (BNFTCOD EQ 03 AND TYPSAV EQ 3) BNFT=RND(AUSAV*USEFACTR*INFO*PV)
*IF             (BNFTCOD EQ 04 AND TYPSAV EQ 1) BNFT=RND(ITMSAV*USEFACTR*INFO)
*IF             (BNFTCOD EQ 04 AND TYPSAV EQ 2) BNFT=RND(AMSAV*USEFACTR*INFO*PV)
*IF             (BNFTCOD EQ 04 AND TYPSAV EQ 3) BNFT=RND(AUSAV*USEFACTR*INFO*PV)
*IF             (BNFTCOD EQ 05 AND TYPSAV EQ 1) BNFT=RND(ITMSAV*USEFACTR*INFO)
*IF             (BNFTCOD EQ 05 AND TYPSAV EQ 2) BNFT=RND(AMSAV*USEFACTR*INFO*PV)
*IF             (BNFTCOD EQ 05 AND TYPSAV EQ 3) BNFT=RND(AUSAV*USEFACTR*INFO*PV)
*IF             (BNFTCOD EQ 06 AND TYPSAV EQ 1) BNFT=RND(ITMSAV*USEFACTR*INFO)
*IF             (BNFTCOD EQ 06 AND TYPSAV EQ 2) BNFT=RND(AMSAV*USEFACTR*INFO*PV)
*IF             (BNFTCOD EQ 06 AND TYPSAV EQ 3) BNFT=RND(AUSAV*USEFACTR*INFO*PV)
*IF             (BNFTCOD EQ 07 AND TYPSAV EQ 4) BNFT=RND(PRJCST*.1*USEFACTR*INFO)
*IF             (BNFTCOD EQ 08 AND TYPSAV EQ 4) BNFT=RND(PRJCST*.1*USEFACTR*INFO)
*IF             (BNFTCOD EQ 09 AND TYPSAV EQ 4) BNFT=RND(PRJCST*.1*USEFACTR*INFO)
*IF             (BNFTCOD EQ 10 AND TYPSAV EQ 4) BNFT=RND(PRJCST*.1*USEFACTR*INFO)
*IF             (BNFTCOD EQ 11 AND TYPSAV EQ 4) BNFT=RND(PRJCST*.1*USEFACTR*INFO)
*IF             (BNFTCOD EQ 12 AND TYPSAV EQ 4) BNFT=RND(PRJCST*.1*USEFACTR*INFO)
*IF             (BNFTCOD EQ 13) BNFT=0
*IF             (BNFTCOD EQ 14) BNFT=0
*IF             (BNFTCOD EQ 15) BNFT=0
LIST CASES      CASES=2000/VARIABLES=CNTRLNR,BNFTEST,BNFTCOD,BNFT,TYPSAV
BREAKDOWN       TABLES=BNFT BY TYPSAV
COMMENT
COMMENT         END SUMMARY OF EVALUATED BENEFITS BY TYPE OF SAVINGS - REPORT 18
COMMENT
COMMENT         $$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
COMMENT
```

Figure 39 Assistance Benefit Report #18 - Task Definition Logic

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COMMENT
COMMENT         $$$$
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COMMENT
COMMENT         $$$$
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COMMENT
COMMENT         $$$$
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COMMENT
COMMENT         $$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
COMMENT
COMMENT         BEGIN COMPARISON OF BENEFIT ESTIMATE AND BENEFIT - REPORT 21
COMMENT
TASK NAME       COMPARISON OF BENEFIT ESTIMATE AND BENEFIT - REPORT 21
*SELECT IF       (EVAL EQ 1)
*IF              (BNFTCOD EQ 01 AND TYPSAV EQ 1) BNFT=RND(ITMSAV*USEFACTR*INFU)
*IF              (BNFTCOD EQ 01 AND TYPSAV EQ 2) BNFT=RND(AMSAV*USEFACTR*INFU*PV)
*IF              (BNFTCOD EQ 01 AND TYPSAV EQ 3) BNFT=RND(AUSAV*USEFACTR*INFU*PV)
*IF              (BNFTCOD EQ 02 AND TYPSAV EQ 1) BNFT=RND(ITMSAV*USEFACTR*INFU)
*IF              (BNFTCOD EQ 02 AND TYPSAV EQ 2) BNFT=RND(AMSAV*USEFACTR*INFU*PV)
*IF              (BNFTCOD EQ 02 AND TYPSAV EQ 3) BNFT=RND(AUSAV*USEFACTR*INFU*PV)
*IF              (BNFTCOD EQ 03 AND TYPSAV EQ 1) BNFT=RND(ITMSAV*USEFACTR*INFU)
*IF              (BNFTCOD EQ 03 AND TYPSAV EQ 2) BNFT=RND(AMSAV*USEFACTR*INFU*PV)
*IF              (BNFTCOD EQ 03 AND TYPSAV EQ 3) BNFT=RND(AUSAV*USEFACTR*INFU*PV)
*IF              (BNFTCOD EQ 04 AND TYPSAV EQ 1) BNFT=RND(ITMSAV*USEFACTR*INFU)
*IF              (BNFTCOD EQ 04 AND TYPSAV EQ 2) BNFT=RND(AMSAV*USEFACTR*INFU*PV)
*IF              (BNFTCOD EQ 04 AND TYPSAV EQ 3) BNFT=RND(AUSAV*USEFACTR*INFU*PV)
*IF              (BNFTCOD EQ 05 AND TYPSAV EQ 1) BNFT=RND(ITMSAV*USEFACTR*INFU)
*IF              (BNFTCOD EQ 05 AND TYPSAV EQ 2) BNFT=RND(AMSAV*USEFACTR*INFU*PV)
*IF              (BNFTCOD EQ 05 AND TYPSAV EQ 3) BNFT=RND(AUSAV*USEFACTR*INFU*PV)
*IF              (BNFTCOD EQ 06 AND TYPSAV EQ 1) BNFT=RND(ITMSAV*USEFACTR*INFU)
*IF              (BNFTCOD EQ 06 AND TYPSAV EQ 2) BNFT=RND(AMSAV*USEFACTR*INFU*PV)
*IF              (BNFTCOD EQ 06 AND TYPSAV EQ 3) BNFT=RND(AUSAV*USEFACTR*INFU*PV)
*IF              (BNFTCOD EQ 07 AND TYPSAV EQ 4) BNFT=RND(PRJCST*.1*USEFACTR*INFU)
*IF              (BNFTCOD EQ 08 AND TYPSAV EQ 4) BNFT=RND(PRJCST*.1*USEFACTR*INFU)
*IF              (BNFTCOD EQ 09 AND TYPSAV EQ 4) BNFT=RND(PRJCST*.1*USEFACTR*INFU)
*IF              (BNFTCOD EQ 10 AND TYPSAV EQ 4) BNFT=RND(PRJCST*.1*USEFACTR*INFU)
*IF              (BNFTCOD EQ 11 AND TYPSAV EQ 4) BNFT=RND(PRJCST*.1*USEFACTR*INFU)
*IF              (BNFTCOD EQ 12 AND TYPSAV EQ 4) BNFT=RND(PRJCST*.1*USEFACTR*INFU)
*IF              (BNFTCOD EQ 13) BNFT=0
*IF              (BNFTCOD EQ 14) BNFT=0
*IF              (BNFTCOD EQ 15) BNFT=0
*RECODE          BNFT(0=1)(1 THRU 499=2)(500 THRU 4999=3)(5000 THRU 24999=4)
                 (25000 THRU HIGHEST=5)
CROSSTABS        VARIABLES=BNFTEST(1,6) BNFT(1,5)/
                 TABLES=BNFTEST BY BNFT
OPTIONS          1
COMMENT
COMMENT         END COMPARISON OF BENEFIT ESTIMATE AND BENEFIT - REPORT 21
COMMENT
COMMENT         $$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
COMMENT
```

Figure 43 Assistance Benefit Report #21 - Task Definition Logic

APPENDIX J

ASSISTANCE PROGRAM BENEFIT OUTPUT REPORTS

44 Assistance Program Benefit, Original Estimate of Total Benefits - Report #12

45 Assistance Program Benefit, Breakdown of Evaluation Status - Report #13

46 Assistance Program Benefit, Breakdown of Field Evaluation Data - Report #14

47 Assistance Program Benefit, Comparison of Contribution and Information Provided - Report #15

48 Assistance Program Benefit, Summary of Savings by Type of Savings - Report #16

49 Assistance Program Benefit, Estimated Minimum Benefit of Evaluated Requests - Report #17

50 Assistance Program Benefit, Summary of Evaluated Benefits by Type of Benefit - Report #18

51 Assistance Program Benefit, Statistics for Evaluated Benefits - Report #18A

52 Assistance Program Benefit, Summary of Benefits by Benefit Codes - Report #19

53 Assistance Program Benefit, Estimated Minimum Remaining Benefit by Benefit Estimates - Report #20

54 Assistance Program Benefit, Comparison of Benefit Estimate and Benefit - Report #21

- - - - - - - - - - - - - - - - - DESCRIPTION OF SUBPOPULATIONS - - - - - - - - - - - - - - - -

CRITERION VARIABLE BNFT BENEFIT
BROKEN DOWN BY BNFTEST ESTIMATE OF BENEFIT

- - - - - - - - - - - - - - - - -

BNFTEST ESTIMATE OF BENEFIT BY EVAL EVALUATION

CROSSTABULATION OF

BNFTEST	COUNT / ROW PCT / COL PCT / TOT PCT	EVAL BLANK (0)	0 (1)	1 TO 499 (2)	ROW TOTAL
1		0	0	25	25
		0	0	100.0	17.2
		0	0	83.3	
		0	0	17.2	
2		9	10	0	19
		47.4	52.6	0	13.1
		12.9	22.2	0	
		6.2	6.9	0	
3		49	24	0	73
		67.1	32.9	0	50.3
		70.0	53.3	0	
		33.8	16.6	0	
4		10	8	0	18
		55.6	44.4	0	12.4
		14.3	17.8	0	
		6.9	5.5	0	
5		2	3	0	5
		40.0	60.0	0	3.4
		2.9	6.7	0	
		1.4	2.1	0	
6		0	0	5	5
		0	0	100.0	3.4
		0	0	16.7	
		0	0	3.4	
COLUMN TOTAL		70	45	30	145
		48.3	31.0	20.7	100.0

Figure 45 Assistance Program Benefit, Breakdown of Evaluation Status - Report #13

BNFTEST ESTIMATE OF BENEFIT

CATEGORY LABEL	CODE	ABSOLUTE FREQUENCY	RELATIVE FREQUENCY (PERCENT)	ADJUSTED FREQUENCY (PERCENT)	CUMULATIVE ADJ FREQ (PERCENT)
	2	10	22.2	22.2	22.2
	3	24	53.3	53.3	75.6
	4	8	17.8	17.8	93.3
	5	3	6.7	6.7	100.0
	TOTAL	45	100.0	100.0	

VALID CASES 45 MISSING CASES 0

Figure 46 Assistance Program Benefits, Breakdown of Field Evaluation Data, Estimate of Benefit - Report #14

ANYBNFT ANY BENEFIT

CATEGORY LABEL	CODE	ABSOLUTE FREQUENCY	RELATIVE FREQUENCY (PERCENT)	ADJUSTED FREQUENCY (PERCENT)	CUMULATIVE ADJ FREQ (PERCENT)
YES	1	42	93.3	93.3	93.3
NO	2	3	6.7	6.7	100.0
	TOTAL	45	100.0	100.0	

VALID CASES 45 MISSING CASES 0

Figure 46 Assistance Program Benefits, Breakdown of Field Evaluation Data, Any Benefit - Report #14

NOBNFT NO BENEFIT

CATEGORY LABEL	CODE	ABSOLUTE FREQUENCY	RELATIVE FREQUENCY (PERCENT)	ADJUSTED FREQUENCY (PERCENT)	CUMULATIVE ADJ FREQ (PERCENT)
NO INFO AVAILABLE	2	1	2.2	33.3	33.3
INFO NOT RELATED	4	1	2.2	33.3	66.7
DIDN'T AGREE	5	1	2.2	33.3	100.0
OUT OF RANGE		42	93.3	MISSING	100.0
	TOTAL	45	100.0	100.0	

VALID CASES 3 MISSING CASES 42

Figure 46 Assistance Program Benefits, Breakdown of Field Evaluation Data, No Benefit - Report #14

BNFTCOD BENEFIT CODE

CATEGORY LABEL	CODE	ABSOLUTE FREQUENCY	RELATIVE FREQUENCY (PERCENT)	ADJUSTED FREQUENCY (PERCENT)	CUMULATIVE ADJ FREQ (PERCENT)
ACTION TAKEN, ESTIMA	1	7	15.6	15.6	15.6
ACTION PLANNED, FUND	2	3	6.7	6.7	22.2
ACTION CONSIDERED, T	5	1	2.2	2.2	24.4
ACTION TAKEN, NOT ES	7	9	20.0	20.0	44.4
ACTION PLANNED, FUND	8	3	6.7	6.7	51.1
ACTION CONSIDERED, M	12	1	2.2	2.2	53.3
GENERAL INFO	13	18	40.0	40.0	93.3
NO BENEFIT	14	3	6.7	6.7	100.0
	TOTAL	45	100.0	100.0	

VALID CASES 45 MISSING CASES 0

Figure 46 Assistance Program Benefits, Breakdown of Field Evaluation Data, Benefit Code - Report #14

USE USE OF ADVICE OR ASSISTANCE

CATEGORY LABEL	CODE	ABSOLUTE FREQUENCY	RELATIVE FREQUENCY (PERCENT)	ADJUSTED FREQUENCY (PERCENT)	CUMULATIVE ADJ FREQ (PERCENT)
DIRECTLY IMPLEMENTED	11	17	37.8	42.5	42.5
DIRECT IMPLEMENTATIO	21	5	11.1	12.5	55.0
IMPLEMENTATION CONSI	31	3	6.7	7.5	62.5
IMPLEMENTATION CONSI	32	1	2.2	2.5	65.0
GENERAL INFORMATION	41	7	15.6	17.5	82.5
OTHER	51	7	15.6	17.5	100.0
OUT OF RANGE		5	11.1	MISSING	100.0
	TOTAL	45	100.0	100.0	

VALID CASES 40 MISSING CASES 5

Figure 46 Assistance Program Benefits, Breakdown of Field Evaluation Data, Use of Advice or Assistance - Report #14

TYPSAV TYPE OF SAVING

CATEGORY LABEL	CODE	ABSOLUTE FREQUENCY	RELATIVE FREQUENCY (PERCENT)	ADJUSTED FREQUENCY (PERCENT)	CUMULATIVE ADJ FREQ (PERCENT)
SAVINGS IN ONE TIME	1	2	4.4	6.3	6.3
SAVINGS IN ANNUAL MA	2	6	13.3	18.8	25.0
SAVINGS IN ANNUAL O	3	3	6.7	9.4	34.4
NOT ESTIMABLE	4	12	26.7	37.5	71.9
OTHER	5	9	20.0	28.1	100.0
OUT OF RANGE		13	28.9	MISSING	100.0
	TOTAL	45	100.0	100.0	

VALID CASES 32 MISSING CASES 13

Figure 46 Assistance Program Benefits, Breakdown of Field Evaluation Data, Type of Savings - Report # 14

CONTRIB CONTRIBUTION OF ADVICE OR ASSISTANCE TO

CATEGORY LABEL	CODE	ABSOLUTE FREQUENCY	RELATIVE FREQUENCY (PERCENT)	ADJUSTED FREQUENCY (PERCENT)	CUMULATIVE ADJ FREQ (PERCENT)
CONFIRMED AN EARLIER	1	10	22.2	28.6	28.6
HELPED SELECT BTWN K	2	9	20.0	25.7	54.3
PROVIDED INFO USED F	3	12	26.7	34.3	88.6
PROVIDED RECOMMENDAT	4	4	8.9	11.4	100.0
OUT OF RANGE		10	22.2	MISSING	100.0
	TOTAL	45	100.0	100.0	

VALID CASES 35 MISSING CASES 10

Figure 46 Assistance Program Benefits, Breakdown of Field Evaluation Data, Contribution of Advice or Assistance - Report #14

INFO PERCENT OF INFORMATION PROVIDED BY CEL C

CATEGORY LABEL	CODE	ABSOLUTE FREQUENCY	RELATIVE FREQUENCY (PERCENT)	ADJUSTED FREQUENCY (PERCENT)	CUMULATIVE ADJ FREQ (PERCENT)
	20	3	6.7	11.1	11.1
	30	5	11.1	18.5	29.6
	40	1	2.2	3.7	33.3
	50	4	8.9	14.8	48.1
	60	5	11.1	18.5	66.7
	70	2	4.4	7.4	74.1
	80	4	8.9	14.8	88.9
	90	1	2.2	3.7	92.6
	100	2	4.4	7.4	100.0
OUT OF RANGE		18	40.0	MISSING	100.0
	TOTAL	45	100.0	100.0	

VALID CASES 27 MISSING CASES 18

Figure 46 Assistance Program Benefits, Breakdown of Field Evaluation Data, Percentage of Information Provided By CEL - Report #14

OTHRUSE WOULD SOLUTION BE APPLICABLE TO OTHER AC

CATEGORY LABEL	CODE	ABSOLUTE FREQUENCY	RELATIVE FREQUENCY (PERCENT)	ADJUSTED FREQUENCY (PERCENT)	CUMULATIVE ADJ FREQ (PERCENT)
YES	1	38	84.4	97.4	97.4
NO	2	1	2.2	2.6	100.0
OUT OF RANGE		6	13.3	MISSING	100.0
	TOTAL	45	100.0	100.0	

VALID CASES 39 MISSING CASES 6

Figure 46 Assistance Program Benefits, Breakdown of Field Evaluation Data, Would Solution Be Applicable To Other Activities - Report #14

* CROSSTABULATION OF *
CONTRIB CONTRIBUTION OF ADVICE OR ASSISTANCE TO BY INFO PERCENT OF INFORMATION PROVIDED BY CEL
* PAGE 1 OF 1

CONTRIB \ INFO	20	30	40	50	60	70	80	90	100	ROW TOTAL
1 CONFIRMED AN EAR	2	1	0	0	2	0	0	0	0	5
	40.0	20.0	0	0	40.0	0	0	0	0	18.5
	66.7	20.0	0	0	40.0	0	0	0	0	
	7.4	3.7	0	0	7.4	0	0	0	0	
2 HELPED SELECT BT	0	1	1	1	0	0	3	0	1	7
	0	14.3	14.3	14.3	0	0	42.9	0	14.3	25.9
	0	20.0	100.0	25.0	0	0	75.0	0	50.0	
	0	3.7	3.7	3.7	0	0	11.1	0	3.7	
3 PROVIDED INFO US	1	3	0	2	3	2	0	0	0	11
	9.1	27.3	0	18.2	27.3	18.2	0	0	0	40.7
	33.3	60.0	0	50.0	60.0	100.0	0	0	0	
	3.7	11.1	0	7.4	11.1	7.4	0	0	0	
4 PROVIDED RECOMME	0	0	0	1	0	0	1	1	1	4
	0	0	0	25.0	0	0	25.0	25.0	25.0	14.8
	0	0	0	25.0	0	0	25.0	100.0	50.0	
	0	0	0	3.7	0	0	3.7	3.7	3.7	
COLUMN TOTAL	3	5	1	4	5	2	4	1	2	27
	11.1	18.5	3.7	14.8	18.5	7.4	14.8	3.7	7.4	100.0

NUMBER OF MISSING OBSERVATIONS = 18

Figure 47 Assistance Program Benefit, Comparison of Contribution and Information Provided - Report #15

DESCRIPTION OF SUBPOPULATIONS

CRITERION VARIABLE ITMSAV ONE TIME CONSTRUCTION OR REPAIR COST SAV
BROKEN DOWN BY TYPSAV TYPE OF SAVING

VARIABLE	CODE	VALUE LABEL	SUM	MEAN	STD DEV	VARIANCE	N
FOR ENTIRE POPULATION			31000.0000	688.8889	3812.7908	.14537E+08	(45)
TYPSAV	0		0	0	0	0	(13)
TYPSAV	1.	SAVINGS IN ONE TIME	31000.0000	15500.0000	13435.0288	.18050E+09	(2)
TYPSAV	2.	SAVINGS IN ANNUAL MA	0	0	0	0	(6)
TYPSAV	3.	SAVINGS IN ANNUAL O	0	0	0	0	(3)
TYPSAV	4.	NOT ESTIMABLE	0	0	0	0	(12)
TYPSAV	5.	OTHER	0	0	0	0	(9)

TOTAL CASES = 45

Figure 48 Assistance Program Benefit, Summary of Saving By Type of Savings, One Time Construction or Repair Cost Saving - Report #16

DESCRIPTION OF SUBPOPULATIONS

CRITERION VARIABLE AUSAV ANNUAL OPERATING COST SAVING
BROKEN DOWN BY TYPSAV TYPE OF SAVING

VARIABLE	CODE	VALUE LABEL	SUM	MEAN	STD DEV	VARIANCE	N
FOR ENTIRE POPULATION			41000.0000	911.1111	4284.3384	.18355E+08	(45)
TYPSAV	0		0	0	0	0	(13)
TYPSAV	1.	SAVINGS IN ONE TIME	0	0	0	0	(2)
TYPSAV	2.	SAVINGS IN ANNUAL MA	0	0	0	0	(6)
TYPSAV	3.	SAVINGS IN ANNUAL O	41000.0000	13666.6667	11930.3534	.14233E+09	(3)
TYPSAV	4.	NOT ESTIMABLE	0	0	0	0	(12)
TYPSAV	5.	OTHER	0	0	0	0	(9)

TOTAL CASES = 45

Figure 48 Assistance Program Benefit, Summary of Saving By Type of Savings, Annual Operating Cost Saving - Report #16

- - - - - - - - - - - - - - - - - DESCRIPTION OF SUBPOPULATIONS - - - - - - - - - - - - - - -

CRITERION VARIABLE AMSAV ANNUAL MAINTENANCE COST SAVING
BROKEN DOWN BY TYPSAV TYPE OF SAVING

- - - - - - - - - - - - - - - - -

DESCRIPTION OF SUBPOPULATIONS

CRITERION VARIABLE BNFT BENEFIT
BROKEN DOWN BY BNFTEST ESTIMATE OF BENEFIT

VARIABLE	CODE	VALUE LABEL	SUM	MEAN	STD DEV	VARIANCE	N
FOR ENTIRE POPULATION			263500.0000	5855.5556	7252.2506	.52595E+08	(45)
BNFTEST	2.		2500.0000	250.0000	0	0	(10)
BNFTEST	3.		66000.0000	2750.0000	0	0	(24)
BNFTEST	4.		120000.0000	15000.0000	0	0	(8)
BNFTEST	5.		75000.0000	25000.0000	0	0	(3)

TOTAL CASES = 45

Figure 49 Assistance Program Benefit, Estimated Minimum Benefit of Evaluated Requests - Report #17

DESCRIPTION OF SUBPOPULATIONS

CRITERION VARIABLE BNFT BENEFIT
BROKEN DOWN BY TYPSAV TYPE OF SAVING

VARIABLE	CODE	VALUE LABEL	SUM	MEAN	STD DEV	VARIANCE	N
FOR ENTIRE POPULATION			324017.0000	7200.3778	14183.1371	.20116E+09	(45)
TYPSAV	0		0	0	0	0	(13)
TYPSAV	1.	SAVINGS IN ONE TIME	23600.0000	11800.0000	11596.5512	.13448E+09	(2)
TYPSAV	2.	SAVINGS IN ANNUAL MA	82910.0000	13818.3333	15329.8881	.23500E+09	(6)
TYPSAV	3.	SAVINGS IN ANNUAL O	103799.0000	34599.6667	36404.2130	.13252E+10	(3)
TYPSAV	4.	NOT ESTIMABLE	113708.0000	9475.6667	10140.2740	.10282E+09	(12)
TYPSAV	5.	OTHER	0	0	0	0	(9)

TOTAL CASES = 45

Figure 50 Assistance Program Benefit, Summary of Evaluated Benefits By Type of Benefit - Report #18

- O N E W A Y -

VARIABLE BNFT BENEFIT
BY TYPSAV TYPE OF SAVING

ANALYSIS OF VARIANCE

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
BETWEEN GROUPS	3	15283750402.2029	5094583467.7343	1.901	.164
WITHIN GROUPS	19	50911175246.6667	2679535539.2986		
TOTAL	22	66194925648.8696			

- O N E W A Y -

VARIABLE BNFT BENEFIT

MULTIPLE RANGE TEST

STUDENT-NEWMAN-KEULS PROCEDURE
RANGES FOR THE .050 LEVEL -

2.96 3.58 3.97

THE ABOVE RANGES ARE TABULAR VALUES. THE VALUE ACTUALLY USED TO COMPARE MEAN(I) TO MEAN(J) IS
RANGE * SQRT(0.5 * WITHIN-GROUPS-MEAN-SQUARES * (1/N(I) + 1/N(J)))

HOMOGENEOUS SUBSETS (SUBSETS OF GROUPS, NO PAIR OF WHICH HAVE MEANS THAT DIFFER BY MORE THAN THE SHORTEST SIGNIFICANT RANGE FOR A SUBSET OF THAT SIZE)

SUBSET 1

GROUP	GRP 4	GRP 1	GRP 2	GRP 3
MEAN	9475.6667	11800.0000	13818.3333	34599.6667

- -

Figure 51 Assistance Program Benefit, Statistics for Evaluated Benefits - Report #18A

DESCRIPTION OF SUBPOPULATIONS

CRITERION VARIABLE BNFT BENEFIT
BROKEN DOWN BY BNFTCOD BENEFIT CODE

VARIABLE	CODE	VALUE LABEL	SUM	MEAN	STD DEV	VARIANCE	N
FOR ENTIRE POPULATION			324017.0000	7200.3778	14183.1371	.20116E+09	(45)
BNFTCOD	1.	ACTION TAKEN, ESTIMA	157148.0000	22449.7143	25076.4681	.62882E+09	(7)
BNFTCOD	2.	ACTION PLANNED, FUND	52922.0000	17640.6667	19249.2847	.37053E+09	(3)
BNFTCOD	5.	ACTION CONSIDERED, T	239.0000	239.0000	0	0	(1)
BNFTCOD	7.	ACTION TAKEN, NOT ES	71418.0000	7935.3333	10514.0031	.11054E+09	(9)
BNFTCOD	8.	ACTION PLANNED, FUND	17290.0000	5763.3333	4050.1893	.16404E+08	(3)
BNFTCOD	12.	ACTION CONSIDERED, M	25000.0000	25000.0000	0	0	(1)
BNFTCOD	13.	GENERAL INFO	0	0	0	0	(18)
BNFTCOD	14.	NO BENEFIT	0	0	0	0	(3)

TOTAL CASES = 45

Figure 52 Assistance Program Benefit, Summary of Benefits By Benefit Code - Report #19

DESCRIPTION OF SUBPOPULATIONS

CRITERION VARIABLE BNFT BENEFIT
BROKEN DOWN BY BNFTEST ESTIMATE OF BENEFIT

VARIABLE	CODE	VALUE LABEL	SUM	MEAN	STD DEV	VARIANCE	N
FOR ENTIRE POPULATION			337000.0000	4814.2857	5708.7661	.32590E+08	(70)
BNFTEST	2.		2250.0000	250.0000	0	0	(9)
BNFTEST	3.		134750.0000	2750.0000	0	0	(49)
BNFTEST	4.		150000.0000	15000.0000	0	0	(10)
BNFTEST	5.		50000.0000	25000.0000	0	0	(2)

TOTAL CASES = 70

Figure 53 Assistance Program Benefit, Estimated Minimum Remaining Benefit By Benefit Estimates - Report #20

* CROSSTABULATION OF * * *
BNFTEST ESTIMATE OF BENEFIT BY BNFT BENEFIT
* *

BNFTEST	COUNT / ROW PCT / COL PCT / TOT PCT	BNFT 1	2	3	4	5	ROW TOTAL
2		8	0	1	1	0	10
		80.0	0	10.0	10.0	0	22.2
		36.4	0	11.1	11.1	0	
		17.8	0	2.2	2.2	0	
3		9	1	8	4	2	24
		37.5	4.2	33.3	16.7	8.3	53.3
		40.9	100.0	88.9	44.4	50.0	
		20.0	2.2	17.8	8.9	4.4	
4		4	0	0	3	1	8
		50.0	0	0	37.5	12.5	17.8
		18.2	0	0	33.3	25.0	
		8.9	0	0	6.7	2.2	
5		1	0	0	1	1	3
		33.3	0	0	33.3	33.3	6.7
		4.5	0	0	11.1	25.0	
		2.2	0	0	2.2	2.2	
COLUMN TOTAL		22	1	9	9	4	45
		48.9	2.2	20.0	20.0	8.9	100.0

Figure 54 Assistance Program Benefit, Comparison of Benefit Estimate and Benefit - Report #21

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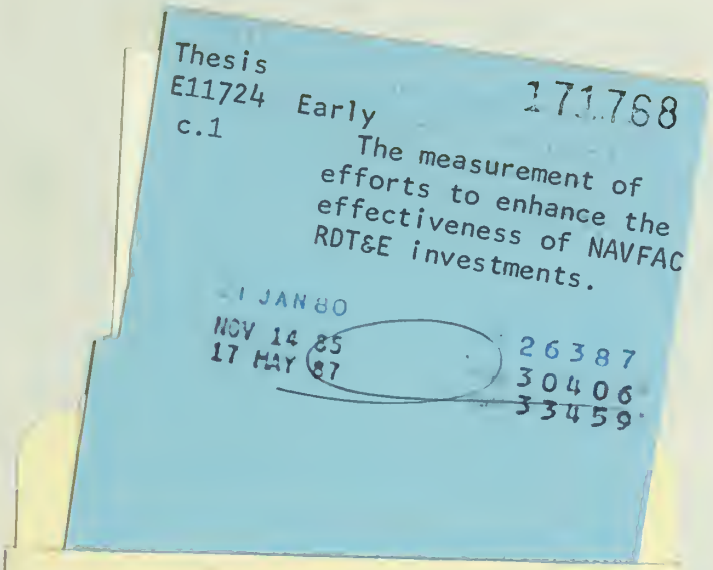
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